



AIS TRANSPONDER MX535B Class A

Manual

ENGLISH





Manual

SIMRAD MX535B Class A AIS Transponder

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Preface

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Compliance

The MX535B Class A AIS Transponder complies with the following regulations

- IMO Res. A.694 (17), IMO Res. MSC. 74(69) Annex 3, IMO Res. MSC. 112(73), IMO Res. MSC. 191(79), ITU-R W.1371-3 (Class A), 2007, ITU-R W.825-3, 1998, ITU-R W 1084-3, 1998
- CE Certified

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The Wheelmark

The MX535B system is produced and tested in accordance with the European Marine Equipment Directive 2010/68/EC and amended by Directive 2011/68/EC. This means that the systems comply with the highest level of tests for nonmilitary marine electronic navigation equipment existing today.

The Marine Equipment Directive 2010/68/EC (MED), as amended by 2011/68/EC for ships flying EU or EFTA flags, applies to all new ships, to existing ships not previously carrying such equipment, and to ships having their equipment replaced.

Navico has no responsibility for incorrect installation or use of the navigation equipment, so it is essential for the person in charge of the installation to be familiar with the relevant requirements as well as with the contents of the manuals, which covers correct installation and use.

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Warranty

The warranty card is supplied as a separate document.

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1 Introduction

1.1 Safety Instructions

This equipment should be installed according to the instructions found in the installation part of this manual.

The equipment should not be mounted in a way that exposes it to excessive heat from the sun or other sources.

The equipment should not be mounted in a flammable environment.

The equipment should not be mounted in a way that exposes it to direct rain or water.

CAUTION!

This equipment contains CMOS integrated circuits. Observe handling precautions to avoid static discharges which may damage these devices.



Do not open equipment. Only qualified personnel should service the equipment.

1.2 Compass Safe Distance

Transponder unit:

Standard Compass: 95 cm

Steering Compass: 65 cm

Display unit:

Standard Compass: 30 cm

Steering Compass: 14 cm

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Simrad does not assume any liability arising out of the application or use of the described product.

1.5 Disposal Instructions

The MX535B Transponder and Display shall be disposed according to local regulations regarding Electronic Waste Recycling in the country the equipment is taken ashore. At time of writing this manual (2012), there are some common regulations which allies:

Europe:

Directive 2002/96/EC (WEEE) Waste Electrical and Equipment Directive
Equipment is labeled with this symbol:



USA:

Most states have implemented some kind of recycling act, but there is not yet a federal law about this issue.

Elsewhere:

Follow local regulations regarding disposal of electronic equipment.

1.6 Software Versions

MX535B ----- V1.00.05
MX510/MX512 --- V3.0

1.7 Ingress protection

Transponder unit: IP56

IPx6

IEC 60945, Exposed

Display unit: IP54

IEC 60945, Protected

2 Operation General Introduction

Thank you for purchasing the Simrad AIS Class A transponder.

The Simrad MX535B has been developed to offer you the highest level of performance and durability and we hope that it will provide many years of reliable service. This product has been designed to meet the highest possible quality standards and should you encounter any problems with this product, please contact your local dealer for assistance.

2.1 About AIS in general

The Automatic Identification System (AIS) is based on the IMO regulation for AIS using Self Organized Time Division Multiple Access (SOTDMA) technology based on a VHF Data Link (VDL).

The system operates in the following modes:

- Autonomous (continuous operation in all areas)
- Assigned (data transmission interval remotely controlled by authority in traffic monitoring service)
- Polled (in response to interrogation from a ship or authority)
- Silent (listening only, use with caution)

The system is synchronized with GPS time (UTC) to avoid conflict among multiple users. If GPS data is not available, the system is self-synchronized using the VDL message.

The VHF channels 2087 and 2088 are the main AIS channels in addition to local AIS frequencies. AIS transponders onboard ships exchange various data as specified by IMO and ITU on either frequency set up by:

- The frequency management telecommand (DSC)
- Special AIS messages sent from an AIS Base station
- Manual input of special region

The normal transmit power is 12.5 W, but under certain conditions, as during tanker loading (according to ISGOTT regulation), or the use of regional settings, a low power option (1 W) is automatically selected.

3 Equipment List

3.1 Standard Supply

There are four different system packages available for the MX535B AIS systems. Refer to the tables below for included items in each package.

MX535B AIS system packages

MX535B AIS+MX510 CDU MKD* system (P/N 000-11129-001)

Part No.	Name	Type	Qty.
985-10631-001	MX535B Transponder Unit	AIS	1
3508-102-70860	MX535B Operator and Installation Manual		1
510-000-0000	MX510 Display Unit	CDU	1
510-100-2001	Mounting bracket, Display unit		1
AN156	GPS Globe Antenna		1
000-10232-001	AIS (MKD) License	MKD	1

MX535B AIS+MX512 CDU MKD* system (P/N 000-11130-001)

Part No.	Name	Type	Qty.
985-10631-001	MX535B Transponder Unit	AIS	1
3508-102-70860	MX535B Operator and Installation Manual		1
512-000-0000	MX512 Display Unit	CDU	1
512-100-1001	MX512 JUNCTION		1
510-100-2001	Mounting bracket, Display unit		1
AN156	GPS Globe Antenna		1
000-10232-001	AIS (MKD) License	MKD	1

MX535B AIS+MX512 CDU+MX521A DGPS NAV system (P/N 000-11131-001)

Part No.	Name	Type	Qty.
985-10631-001	MX535B Transponder Unit	AIS	1
3508-102-70860	MX535B Operator and Installation Manual		1
512-000-0000	MX512 Display Unit	CDU	1
727051	MX521A DGPS Smart Antenna	DGPS	1
512-100-1001	MX512 JUNCTION		1
510-100-2001	Mounting bracket, Display unit		1
AN156	GPS Globe Antenna		1
000-10232-001	AIS License	MKD	1

MX535B Upgrade (Upgrade MX512 only) (P/N 000-11129-001)

Part No.	Name	Type	Qty.
985-10631-001	MX535B Transponder Unit	AIS	1
3508-102-70860	MX535B Operator and Installation Manual		1
AN156	GPS Globe Antenna		1
000-10232-001	AIS License		1

3.2 Optional Supply

The items below can be ordered separately through us or through a third party supplier.

Part No.	Name	Connector Type
9525-200-80230	CX4 VHF Antenna	PL259
	Antenna Cable for VHF antenna	PL259-BNC
	Antenna Cable for GPS antenna	TNC-TNC
	Pilot Plug Cable assembly	
	Antenna Mounting Bracket	1"-14 TPI
	Interconnect cable (2x shielded twisted-pair)	
	MX521 Antenna Cable	10-Pin connector

*MKD – Minimum Keyboard and Display – The MX51x CDU does not feature any navigation capabilities hence the MX antenna is not required. Position data is supplied by the built-in GPS in the MX535B AIS transponder.

4 MX535 Description

The AIS system consists of two separate units interconnected by 2-Pairs shielded cable. The MX535B Transponder is the main unit, handling the basic AIS functionality, including sensors and RF functions, while the MX51x Display unit is used for setup and display of the AIS data as well as optional interface to on-board electronics.

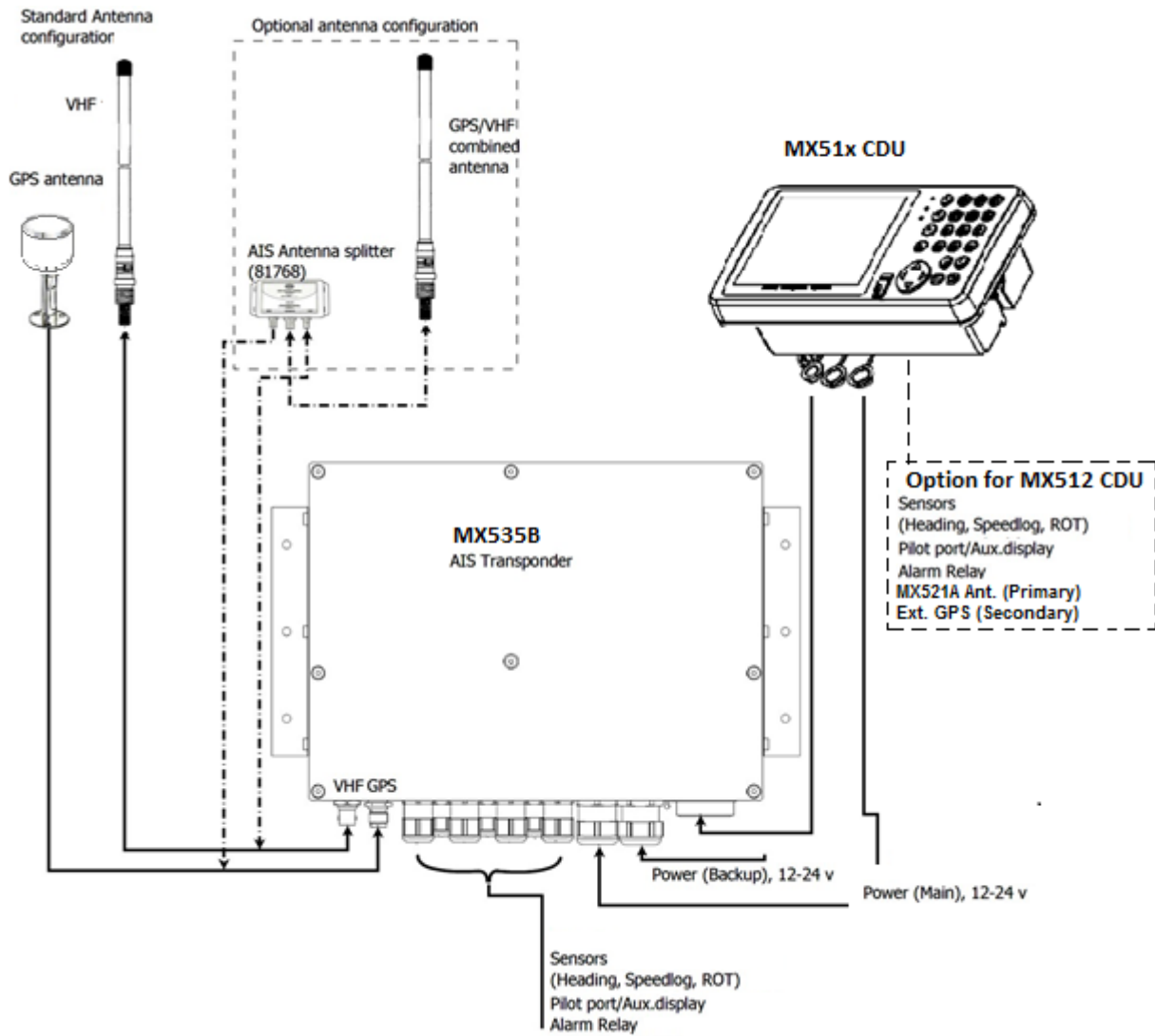


Figure 4.1 MX535 System Diagram

4.1 Functionality

The main features are: Safety of navigation by automatically exchanging navigational data between ships (Class A transponders), coast stations, Class B transponders and receiving positional data from AIS-SARTs (Search and Rescue beacons) and A to Ns (Aids to Navigation).

- Class A AIS transmitter and receiver (transponder)
- Class B compatible (receives all Class B messages)
- Short safety related messages and other short messages
- MKD panel Interfaces for AIS compatible radar, ECDIS/ECS/Chart plotter
- GPS and VHF antenna separate or combined, for easy installation available
- Built-in GPS receiver for time synchronization and backup position
- SD-Card slot for future upgrades

The information exchanged between ships using AIS transponders are:

Static data:

- MMSI (Maritime Mobile Service Identity) IMO number (where available)
- Call sign and name
- Length and beam
- Type of ship
- Location of position-fixing antenna on the ship

Dynamic data:

- Ship's position with accuracy indication and integrity status UTC
- Course over ground (COG)
- Speed over ground (SOG)
- Heading
- Rate of turn (where available)

Voyage related data:

- Navigation status (manual input)
- Ship's draught
- Hazardous (cargo type)
- Destination and ETA (at masters' discretion)

4.2 Transponder Unit

Front view



Side view



The Transponder Unit contains all the core functionality of the AIS system and can function as a separate unit connected to other display solutions confirming with the AIS message format. It consists of a splash proof aluminum casing with the following connection possibilities:

- VHF antenna and GPS Antenna
- External display connections ("Ecdis Port" and "Pilot/Aux Port")
- Sensor connections
- DGNSS/DGPS
- Beacon receiver connection
- Alarm relay

Complies with the environmental requirements specified in IEC 60945 Ed.4 Exposed, and is certified for IP56 /IPX6. The operating temperature is from -25°C to +55°C and storage temperature from -30°C to +70°C

The receiving section of the Transponder consists of three VHF receiver circuits, for continuous reception on both AIS channels (configurable from 154 MHz-164 MHz) and the DSC channel (ch70). The transmitter circuitry is connected to the same antenna terminal and is switched internally.

Functionality for direct reporting with satellites (Long-range AIS broadcast) is implemented and operates when so configured by the competent authorities.

The internal power supply of the Transponder is galvanically isolated in order to protect the internal circuitry and operates in a wide voltage input range from 10.8 V–31.2 V. A backup power source can be connected if available. Automatically switching to backup power source will take place if the main source of power is lost.

4.2.1 LED Indicators:

Transmission
Reception Alarm
Status



4.2.2 Main functionality:

Transmit and receive AIS data packets over the VHF link
Receive DSC messages
Provide time and position data from internal GPS
Receive and handle data from external sensors
Provide information about own and other ships positions to the display units, both the MX535B MX51x Display unit, and to high speed ports like “External Display” and “Pilot/Aux Display”

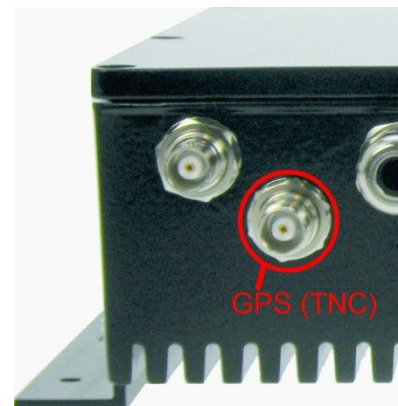
4.2.3 VHF antenna connector

This is a BNC type antenna connector to be connected directly to a CX4 external VHF antenna to receive and transmit VHF frequencies.



4.2.4 GPS antenna connector

This is a TNC type antenna connector to be connected directly to an external GPS globe antenna to receive GPS information.



Note: A combination VHF/GPS antenna may also be used with an antenna splitter in place of the separate VHF and GPS antennas.

4.2.5 LAN (Ethernet) Connector

RJ45 type waterproof Ethernet connection (NOT USED)



4.2.6 Multipurpose cable glands

The Transponder Unit is fitted with 9 multi-purpose cable glands for waterproof, shielded connection with the unit. There are 3 different sizes in order for the best possible fit for different cable types. All wiring should be drawn in shielded cables connected to the chassis of the Transponder by the cable glands.



Max Quantity	Min Cable Outer Ø [mm]	Max Cable Outer Ø [mm]	Minimum Ø above braiding [mm]	Recommended use
3	3.5	7	2	Sensors
4	4.5	9	4	Communication
2	7	12.5	5	Power

Table 1: Quantity and specification of multipurpose cable glands

4.3 MX510/512 Display Unit



MX51x Front View

The MX51x (MX510 or MX512) Display unit is the user interface for the AIS system on the bridge. It is used to configure the MX535B system and to present AIS data about own and other ships, both graphically and in list form. The MX510 model is used as an MKD (Minimum Keyboard and Display) for the AIS, while the MX512 can be both an MKD as well as navigation unit. The MX51x Display Unit consists of a splash proof housing with a 6 inch LCD black/white display. Splash proof connections for Power/Data, AUX, Antenna, USB and LAN are present on the back side of the unit. The operating voltage range of the display and AIS transponder is from 10.8 – 31.2 VDC. A Backup power (12-24 VDC) source can be connected to the MX535B if available. This will be automatically switched in if the main source of power is lost.



MX512 Rear View



MX510 (MKD) Rear View

The main features of the MX51x AIS Display Unit are:

- Give the user information about other ships with AIS in the vicinity
- Enable the user to obtain information about other ships and send and receive safety messages to other ships with AIS Transponders
- Enable the user to configure the AIS System. Alert the user about alarms from the AIS system
- Pilot Port connection can be done directly to the transponder or to the MX51x Display Unit
- Provide NMEA data port connection(s) to on-board electronics
- Certified to IP54 and IEC 60945 Ed.4 "Protected"
- Operating temperature from -25°C to +55°C and storage temperature from -30°C to +70°C.

5 Operational description

The operational description chapter assumes that the MX535B AIS Transponder and the MX51x display are fully installed using the instructions found in the Installation chapter.

5.1 Powering the MX535B system

The MX535B turns on as soon as the external 12-24 VDC supply is connected to its terminals. It is recommended that the external power to the unit be wired to a fuse or a circuit breaker for safety and convenience. It will take about 1 minute warm-up time before the VHF transmission starts.

The power switch of the MX51x display unit does not control the power to the Transponder. Even if you turn OFF the MX51x display, the AIS transponder will still be active. Note that the ship list will need some time to recover when turning the Display unit on again. This is dependent on when the messages from the different vessels are received. The message logs for sent and received messages will also be lost.

Note that the Transponder unit will issue an alarm when the display is shut down, and there may be no means to acknowledge this alarm if the display is turned off!

5.1.1 Powering the MX51x display

To turn on the MX51x display, press the power key momentarily. To turn off, press the power key, then highlight the YES softkey and press the ENT key or you can press and hold down the power key for 5 seconds.

5.2 AIS General Setup

5.2.1 AIS System Setup

Prior to using the MX535B AIS system, it is necessary to configure the AIS menus under the CFG key of the MX51x CDU, namely:

- AIS Config
- AIS Static
- AIS Voyage

To access the AIS configuration setups, follow the procedure below.

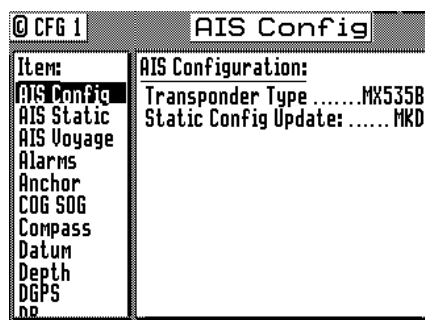
AIS Config Setup

The MX51x/AIS display was designed to work with several types of class “A” AIS transponder systems. The “Transponder type:...MX535B” setup allows the operator to customize the MX51x/AIS display to work with SAAB (R3), ATLAS, NAUTICAST or MX535B transponder models (other selections may become available in the future).

The “Static Config Update:” setup is used to determine where the AIS configuration can be controlled from. Two possible selections are the MKD (MX510 or MX512 CDU) or ECDIS. The MKD is the default setting.

Follow the procedure below to select the “Transponder Type” and “Static Config Update” settings:

1. Press the **CFG** key.
2. Scroll to AIS Config menu.



3. Press the **EDIT** key (cursor will be on Transponder Type). Default selection is MX535B.
4. Press the **ENT** to activate the CHANGE softkey to toggle to a different transponder model.
5. If you need to pass control to the ECDIS system, press the Down arrow key to highlight the “Static Config Update: ... MKD” line.
6. Press the **ENT** key to change to ECDIS (MKD is the default setting).
7. Press the **EDIT** to exit.

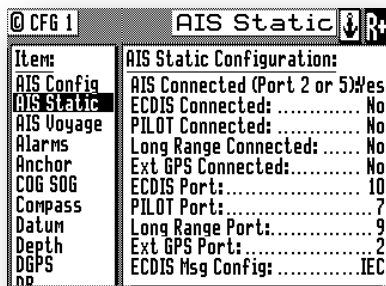
5.2.1.1 AIS Static Setup

The AIS Static Setup contains both the ship’s static data and AIS transponder configuration. This setup must be done after installation or at any time changes are made to the ship’s AIS transponder unit.

It is important to note that critical AIS static setup items (such as MMSI, IMO, Ship name & Call Sign) are password protected. Setup items that require administrator password are indicated in the *Display Field Descriptions* below. If an invalid or missing password is used, an alarm is displayed and the entry will be rejected. Press the ‘Cancel alarm’ softkey to continue.

Follow the procedure below to enter the required AIS static information:

1. Press **CFG** key.
2. Highlight the **AIS Static** under the ‘Item’ column.
3. Press the **EDIT** key to start editing the AIS Static setup.



4. The "AIS Connected (Port 5):... No" will be highlighted, press the **ENT** key to activate the **Change** softkey to change the value to "Yes".
5. Move the highlight to other required setup items and enter the numeric values or press the **ENT** key to toggle the value. You will need to use the "admin" password to change critical values in the AIS Static menu.
6. Press **EDIT** key when done editing the AIS Static menu.

More AIS Static configuration parameters are available by scrolling down using the down arrow cursor key as shown below.



CFG 1 AIS Static	
Item:	AIS Static Configuration:
AIS Config	AIS Connected (Port 2 or 5): Yes
AIS Static	ECDIS Connected: No
AIS Voyage	PILOT Connected: No
Alarms	Long Range Connected: No
Anchor	Ext. GPS Connected: No
COG SOG	ECDIS Port: 10
Compass	PILOT Port: 7
Datum	Long Range Ports: 9
Depth	Ext. GPS Port: 2
DGPS	ECDIS Msg Config: IEC
no	



CFG 1 AIS Static	
Item:	AIS Static Configuration:
AIS Config	ECDIS Msg Config: IEC
AIS Static	PILOT Msg Config: IEC
AIS Voyage	Long Range Reply: MANUAL
Alarms	MMSI: 338124561
Anchor	Ship: JOTRON
COG SOG	Call Sign: TEST
Compass	IMO Number: 2386801
Datum	Chnl A & B - TX Mode: Transmit
Depth	MX Ant: Primary
DGPS	External GPS: Secondary
no	



CFG 1 AIS Static	
Item:	AIS Static Configuration:
AIS Config	Passthru NMEA: No
AIS Static	MX Ant A: 0m
AIS Voyage	MX Ant B: 0m
Alarms	MX Ant C: 0m
Anchor	MX Ant D: 0m
COG SOG	Ext. GPS Ant A: 0m
Compass	Ext. GPS Ant B: 0m
Datum	Ext. GPS Ant C: 0m
Depth	Ext. GPS Ant D: 0m
DGPS	AIS GPS Ant A: 0m
no	



CFG 1 AIS Static	
Item:	AIS Static Configuration:
AIS Config	AIS GPS Ant A:..... 0m
AIS Static	AIS GPS Ant B:..... 0m
AIS Voyage	AIS GPS Ant C:..... 0m
Alarms	AIS GPS Ant D:..... 0m
Anchor	Data Timeout:..... 360s
COG SOG	Sensor 1 Baud Rate:..... 4800
Compass	Sensor 2 Baud Rate:..... 4800
Datum	Sensor 3 Baud Rate:..... 4800
Depth	
DGPS	
DP	

Note: A total of 37 lines are available under the AIS Static menu. If only 10 lines are listed, the MX51x may not be communicating with the transponder. Verify that the “AIS Connected” value is set to YES and the correct transponder type is selected.

Display Field Descriptions:

AIS, ECDIS, PILOT, Long Range, Ext. GPS Connected: Use the **CHANGE** softkey by pressing **ENT** key to change the value to Yes.

ECDIS, PILOT, Long Range, Ext. GPS Port: Use the **CHANGE** softkey by pressing the **ENT** key to scroll through the port# to which the device is connected. “AIS Port” is pre-selected to NMEA5, Long-Range Communication port is NMEA 6, ECDIS is on NMEA 7 and the Pilot port is on NMEA 9.

ECDIS and PILOT Msg Config: Use the **CHANGE** softkey by pressing the **ENT** key to change the communication protocol. EIC protocol is preferred by most AIS Transponder.

Long Range Reply: Use the **CHANGE** softkey by pressing the **ENT** key to change value to AUTO, Manual or Off. In Manual mode, the user is prompted to reply to the Long-Range system when interrogated. In Auto mode, the MX51x/AIS will automatically send a reply when interrogated. In Ext. Appl (External Application) mode, the MX51x/AIS passes the request onto the high-speed ports (ECDIS & Pilot), and waits for their response to prepare answer back to long range system.

MMSI: A 9-digit Maritime Mobile Service Identification number used for identification of ship and message (administrator password required).

Note: When editing critical transponder setup items use the “admin” password.

Ship: Enter the vessel name up to 20-characters (administrator password required). The symbol ããããã (or blank) indicates name is not available.

Call Sign: Enter the 7-character vessel’s call sign (administrator password required). The symbol ããããã (or blank) indicates call sign is not available.

IMO Number: Enter the 9-digit IMO identification number when available (administrator password required).

Chnl A & B-TX Mode: Use the **CHANGE** softkey by pressing the **ENT** key to select between Transmit and Silent (administrator password required).

External GPS Ant: You can designate the external GPS to be a primary or secondary source of GPS position. Default value is SECONDARY.

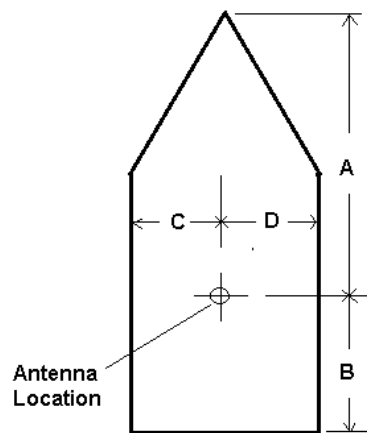
Passthru NMEA: Use the **CHANGE** softkey by pressing the **ENT** key to change the value to YES if you want the NMEA data from the antenna to be passed through to the data ports. Normally set to NO.

MX Ant (A, B, C & D): This sets the location of the PRIMARY source of GPS position antenna. Specify the position location (in meters) See the drawing below.

External GPS Ant (A, B, C, D): This sets the location of the Ext. GPS antenna (a.k.a. Secondary) in meters (similar to the primary GPS Ant A,B,C,D).

AIS GPS Ant A, B, C, D: Specify the position offset of the GPS globe antenna used in the MX535B AIS transponder (administrator password required).

Data Timeout: Allows you to change the time the AIS targets will stay on the MX51x screen to match that of the ECDIS or RADAR AIS targets. Pre-set value is 360 seconds.



Sensor 1 Baud Rate: Controls the baud rate of the MX535B input Sensor Channel 1. 4800 baud is default speed.

Sensor 2 Baud Rate: Controls the baud rate of the MX535B input Sensor Channel 2. 4800 baud is default speed.

Sensor 3 Baud Rate: Controls the baud rate of the MX535B input sensor Channel 3. 4800 baud is default speed.

NOTE: Changing the baud rate requires re-cycling the power to the MX535B for the change to take effect.

How to change transponder settings under the AIS Static configuration using the administrator password:

1. Press the **CFG** key.
2. Scroll down to AIS Static menu.
3. Press the **EDIT** key to bring up the cursor.
4. Move the cursor down to MMSI, Ship or Call Sign field.
5. Move the highlight to SET AIS PASSWORD softkey using the left (or right) arrow key.
6. Press the **ENT** key to commence entry of the "admin" password using the procedure below:
To enter the password "admin" do the following:
 - a. Press the #1 key to bring up the lowercase letter "a".
 - b. The cursor will advance to the next character.
 - c. Press #2 key 1 time to bring-up the letter "d".
 - d. Press the #5 key one time for letter "m".
 - e. Press the #3 key 3 times for letter "i".
 - f. Press the #5 key 2 times for letter "n".
 - g. Highlight the Done softkey, then press the **ENT** key.
7. Move the cursor to the MMSI number and enter the desired value using the numeric keypad.
8. Move the highlight to "Ship:" and spell out the name of the vessel (up to 20 alphanumeric characters).
9. Move the highlight to "Call Sign:" and enter up to 7 characters.

10. To change other setup items use the cursor key to scroll down or up and enter the number or name required.
11. At the end of editing, press the **EDIT** key to exit.

CFG 1		AIS Voyage	
Item:	AIS Voyage Configuration:		
AIS Config	Nav Stat:	Moored	
AIS Static	Destination:		
AIS Voyage	ETA Time:	00:00	
Alarms	ETA Date:	Jan 1, 2010	
Anchor	Draught:	20.0m	
COG SOG	No of People:	5	
Compass	Ship/Cargo Type:	30	
Datum	Fishing Vessel		
Depth			
DGPS			
DP			

5.2.2 AIS Displays

5.2.2.1 AIS Function Key

Several AIS display pages are available under the **AIS** key. Pressing the **AIS** key repeatedly will scroll through the following AIS screens (paging can also be done by using the left or right arrow keys after pressing the AIS key), namely:

- AIS1 - OWN SHIP DATA
- AIS2 - REMOTE SHIP LIST
- AIS3 - RX SAFETY MSGS
- AIS4 - TX SAFETY MSG
- AIS5 - TX SAFETY LIST
- AIS6 - REGIONAL AREAS
- AIS7 - LONG RANGE LIST
- AIS9 - AIS STATUS
- AIS11 - SECURITY LOG
- AIS12 – REMOTE SHIP EPFS
- AIS13 – REMOTE SHIP DATA

AIS 1 – OWN SHIP DATA

This screen shows the ship's information transmitted by the AIS transponder. Information such as ship's name, MMSI#, call sign, IMO#, ship type/cargo, navigation status are all configured under the AIS Static setup, while the destination, Nav stat, ship/cargo type and ETA are taken from the AIS Voyage setup. It also indicates which GPS position is used and its antenna offset data.

AIS 1		OWN SHIP DATA	
Name:	JOTRON	AGE:	0 s
MMSI:	338124562	Nav Stat:	Moored
CallSign:	TEST	Ship/Cargo Type:	30
IMO:	2386800	GPS Source:	PRIMARY
LAT:	33°48.5088N	GPS Ant Pos	A: 000 M
LOn:	118°21.0160W		B: 000 M
COG:	183 °	SOG:	00.0 kn
HDG:	--- °	ROT:	---- °/min
Destination:		ETA Time:	00:00
		Date:	01/01

Display Field Descriptions:

Name: Vessel's name.

MMSI: Maritime Mobile Service Identity number used for identification of ship and message.

Ship/Cargo Type: Ship & Cargo Type (see table A-1 for values).

AGE: Age of the information on the display, in seconds.

Nav Stat: Navigation status as entered in AIS Voyage setup.

CALL SIGN: Assigned radio call sign.

IMO: International Marine Organization number.

GPS Source: Source of the GPS information in use. The choices are Primary (MX421 or MX525 smart GPS sensors), Secondary (external GPS attached to the MX420 CDU), and Backup (Transponder GPS).

Lat/Lon: Position fix of the GPS in use.

GPS Ant Pos: In-use GPS Antenna location (A, B, C & D values see below) with reference to aft of bow and port or starboard of centerline.

HDG: Gyro reading, in degrees.

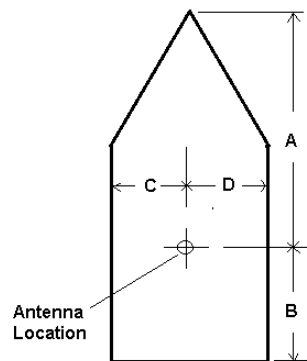
COG: Course Over Ground (degrees).

ETA: Estimated time of arrival (date & time).

ROT: Ship's Rate-Of-Turn, in degrees per minute.

SOG: Speed Over Ground (knots).

Destination: Operator entered destination under the AIS Voyage setup screen.



GPS Antenna Offset Diagram

AIS 2 – Remote Ship List

This display shows a list of target ships equipped with AIS transponders that are being tracked within VHF range. The list can be sorted by range from your location or by bearing. Because of space limitation, only 7 vessels are displayed per page. More target ships can be displayed by pressing the down arrow key repeatedly. You may also press the **EDIT** key and use the **MORE** softkey to display the next screen or go back to the previous screen.

There are five columns available indicating the TGT index #, MMSI, RNG, BRG relative to your position and name of the ship when available.

© AIS 2 REMOTE SHIP LIST				
TGT	MMSI	BRG	RNG	NAME
25	△ 319009300	145	0.1NM	MX
20	△ 372118000	127	4.7NM	YM NEW JERSEY
01	△ 367049470	123	5.1NM	
08	△ 366926740	126	5.4NM	TIM QUIGG
07	△ 366539000	127	5.4NM	
17	△ 366755010	126	5.4NM	
24	△ 366979360	121	5.5NM	

© AIS 2 REMOTE SHIP LIST				
TGT	MMSI	BRG	RNG	NAME
19	△ 538004086	123	4.6NM	MOL MANEUVER
14	△ 636011587	129	4.8NM	YM BAMBOO
60	△ 366979360	121	5.2NM	
56	△ 367004270	133	5.4NM	
42	△ 211367460	123	5.5NM	YANTIAN EXPRESS
02	△ 367366670	111	5.6NM	

SRT BY BRG	← 15°	→ 15°	SRT BY RNG	MORE
---------------	-------	-------	---------------	------

To bring up more targets, press the down arrow key or press the **EDIT** key to bring up the softkeys. You can sort the targets by range or by bearing from your ship. You can scroll left or right by

highlighting the  or  softkey and pressing the **ENT** key to list other ships around you in 15 degree increments. Highlighting the **MORE** softkey and pressing the **ENT** key will allow you to go to the next screen of targets or go back to the previous screen.

© AIS 2 REMOTE SHIP LIST				
TGT	MMSI	BRG	RNG	NAME
16	△ 477920300	116	7.7NM	OOCL ATLANTA
15	△ 372308000	125	7.7NM	ROYAL HARMONY
58	△ 366982340	320	7.8NM	BRYNN FOSS
22	△ 351340000	118	7.9NM	PALMELA
04	△ 372223000	117	7.9NM	KARINE BULKER
43	△ 235067318	129	8.0NM	OCEAN BREEZE
52	△ 355557000	123	8.0NM	

NEXT PAGE	PREV PAGE	BACK
--------------	--------------	------

Display Field Description:

TGT: Target number of MMSI database for quick vessel access. TGT corresponds with vessels shown on the PLOT3 display. The icon indicates the vessel type.

AIS2 icons and their meaning:



(Flag) Class A or Class B vessel



Base Station

+ Search and Rescue (SAR)

⊕ Aids to Navigation

MMSI: Defines the unique vessel ID.

RNG: Range (NM) from your ship to the remote vessel.

BRG: Bearing (Degrees True) from your ship to the remote vessel.

NAME: Name of remote vessel (name is transmitted more seldom than the MMSI#).

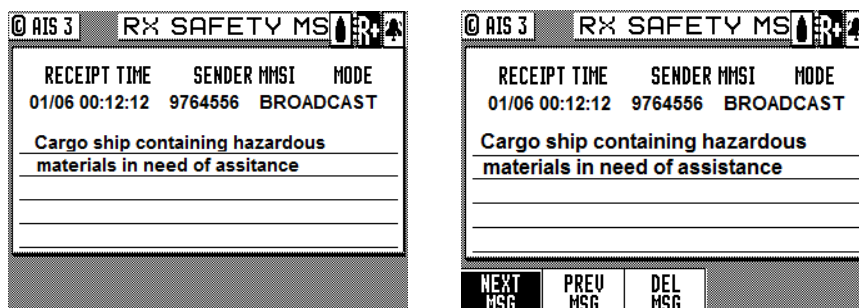
Softkey Descriptions:

-  - User can choose to have a list of MMSIs displayed in 15 degrees increments
-  - Shift bearing search by 15 degrees left
-  - Shift bearing search by 15 degrees right
-  - User can choose to display the MMSIs by distance relative to the vessel
-  - Additional softkeys are available
-  - Shows the next 7 MMSIs
-  - Shows the previous 7 MMSIs
-  - Return to the original softkey setup

5.2.3 AIS 3

AIS3 - RECEIVED (RX) SAFETY MESSAGES

This display stores all AIS safety messages broadcast by other AIS stations or messages addressed to your ship. The MX51x AIS display will retain the last 100 messages received. You have the option to manually delete the message by pressing **EDIT** key then select the  softkey and press **ENT**. When the number of messages exceeds 100, the oldest message will be overwritten.



Display Field Descriptions:

RECEIPT TIME - Date and time the message was received

SENDER MMSI - MMSI of the originator of the message

MODE- ADDRESSED - sent only to this vessel

BROADCAST - sent to all vessels

Text Message received.

Softkey Descriptions:



Highlight this softkey then press **ENT** to display the next message received (maximum of 100 messages are stored in memory)



Highlight this softkey then press **ENT** to display the previous message received



Highlight this softkey then press **ENT** to delete the displayed message

5.2.4 AIS 4

AIS 4 - TRANSMIT (TX) SAFETY MESSAGE

This screen allows you to write and send short text messages dealing with safety at sea and broadcast it to all AIS equipped vessels or address it to a specific vessel.

To send a text message, do the following:

1. Press the **EDIT** key to bring up the cursor to "TGT:"
2. Enter the index (or TGT#) number of the target vessel as listed in the AIS2 screen.

3. The MMSI field will be populated with the MMSI# for the selected vessel.
4. Scroll down to the text string field and type the message using the alphanumeric keypad.
5. Highlight the “Tx MSG” softkeys using the left (or right) arrow key.
6. Press the **ENT** key to transmit.
7. Press the **EDIT** key to exit.

Display Field Descriptions:

OUTPUT CHNL - This field specifies which channel is to be used for sending the safety message.

User can scroll through four different settings. The data displayed in this field can be altered using the TOGGLE CHNL softkey. Start by pressing the **EDIT** key, highlight the TOGGLE CHNL softkey then press the **ENT** repeatedly to toggle through 4 choices, namely: Auto Select, Channel A, Channel B or Both A&B. Default value is Auto Select.

MODE- This field shows whether the message is to be sent to a specific vessel (addressed) or to all (broadcast). Pressing the **TOGGLE MODE** softkey will select either ADDRESSED or BROADCAST

TGT - This requires entry of the TGT index number which is directed to the appropriate MMSI.

MMSI - This field indicates the MMSI number related to the target (TGT) number selected to send the text message to.

TEXT String - Enter the text message to be sent using the alphanumeric keypad.

Softkey Descriptions:

The softkeys can be displayed by pressing the **EDIT** key first.

 - Highlight this soft key then press the **ENT** key to change the channel. The following values are available:

AUTO SELECT - transponder determines on which channel to use

CHANNEL A - broadcast on channel A only

CHANNEL B - broadcast on channel B only

BOTH A & B - broadcast on both channels.

 - Toggles the output mode to either ADDRESSED or BROADCAST. When addressed is selected, the MMSI number will be displayed automatically when the TGT number is specified.

 -Transmits the text message.

 - Use this softkey to bring up more softkeys.

 - sends the number of people to the transponder for transmission.

 - Sends a command to the transponder to transmit the “Height Over Keel” as set in the AIS Static configuration screen.

BACK

- To go back to the previous softkeys

Note: The softkeys can be activated by highlighting it (using the left or right arrow keys) and then pressing the ENT key.

WARNING!

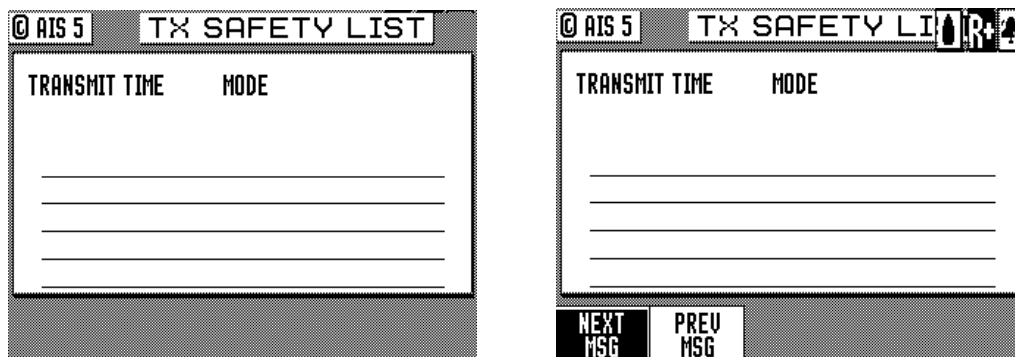
Use of AIS text messages between ships must not be used to avoid collisions when time is critical. AIS systems are not required to have an audible alarm to indicate the arrival of all text messages.

The use of AIS text messaging does not relieve the vessel of other requirements, such as the Vessel Bridge-to-Bridge Radiotelephone regulations or of the requirements to sound whistle signals and display lights or shapes in accordance with the International or Inland Navigation Rules.

Usage During Emergencies - With respect to using AIS safety related text messages in emergency situations, users must be aware that they may not be received, recognized or acted upon as Global Maritime Distress Safety Systems (GMDSS) messages would be by the Coast Guard, other competent authorities or maritime first responders. Thus AIS must not be relied upon as the primary means for broadcasting distress or urgent communications, nor used in lieu of GMDSS such as Digital Selective Calling radios which are designed to process distress messaging. Nonetheless, AIS remains an effective means to augment GMDSS and provides the added benefit of being 'seen' (on radar or chart displays), in addition to being 'heard' (via text messaging) by other AIS users within VHF radio range (Ref: USCG Safety Alert 05-10).

5.2.5 AIS 5 - TX Safety List

This display allows you to review the safety messages you transmitted under the AIS 4 (TX SAFETY MSG) display.



Display Field Description:

Transmit Time - Time the message was transmitted

Mode - Whether it was addressed or broadcast

Message Field

Softkey Description:

NEXT
MSG

- View next message

PREV
MSG

- View previous message

5.2.6 AIS 6 - REGIONAL AREAS

Two VHF and one DSC receiver channels have been designated for AIS use worldwide.

These frequencies are:

- AIS 1 (Channel 87B, 161.975 MHz, (2087)
- AIS 2 (Channel 88B, 162.025 MHz, (2088)
- DSC (Channel 70, 156.525 MHz)

Under normal masterless operation, the MX535B AIS transponder operates autonomously with other ships or AIS base stations using the AIS1 & 2 frequencies. When entering areas controlled by a competent authority (i.e. Coast Guard) under Vehicle Tracking System (VTS) rules, the MX535B AIS transponder can be polled and controlled by the VTS station. In this situation, data communication between ship-to-ship and ship-to-shore stations is done through the DSC frequency (channel 70). All VTS related activities are happening without any user intervention.

The controlling VTS base station schedules all ship's data transmission and provides the regional parameters shown in AIS 6 display, such as:

- Operating frequency, bandwidth and mode of Channel A & B receivers
- Northeast and Southwest corner coordinates of the region
- Zone size
- Date and time tag

These parameters are stored in the memory bank of the AIS transponder and can be displayed in the MX420/AIS CDU. Up to eight regions can be stored by the transponder. The AIS constantly checks the stored region boundaries and compares it to its own position. If the distance to the region boundaries is greater than 500 miles from its own position or the time tag was older than five weeks, those stored regions will be erased from memory.

The operator (administrator) has the option to do a full or partial editing of the regional parameters when needed. The conditions below have to be observed when editing:

- Use the correct channel numbers (see table A-1 or in the AIS card)
- Latitude difference should be no less than 20 NM or larger than 200 NM
- Longitude difference should be no less than 20 NM or larger than 200 NM
- The zone size should be no less than 1 square mile or larger than 8 square miles
- Distance to the zone is less than 500 NM from you current position

Manual entries violating any of the above conditions will be rejected by the AIS transponder without notifying the operator. If the region memory is full, the oldest regional memory will be replaced by a newly accepted one.

© AIS 6 REGIONAL AREAS			
REGION:	IN USE:	BAND	TIME:
	CHANNEL		Tx/Rx
CHNL A:			
CHNL B:			
POWER:			
NE LAT:		SW LAT:	
NE LON:		SW LON:	
ZONE SIZE:		NM.	

© AIS 6 REGIONAL AREAS			
REGION:	IN USE:	BAND	TIME:
	CHANNEL		Tx/Rx
REGION: 1	No		00:00
CHNL A:	0	Normal	Y Y
CHNL B:	0	Normal	Y Y
POWER:	High		
NE LAT:	--°--'	SW LAT:	--°--'
NE LON:	--°--'	SW LON:	--°--'
ZONE SIZE:	-NM.		
DELETE REGION	SEND CHANGES		

Display Field Descriptions:

REGION - Region ID (1- 8)

IN USE - “YES” if the ship is currently operating in the displayed region or “NO” if not

TIME - Time in the region, HH:MM format

CHANNEL - Channel number assigned to channels A & B

BAND - Normal or Narrow bandwidth

TX/RX - Transmit and receive channel status

Values: (N) the channel is not in use

(Y) the channel is in use

POWER - Power level (High or Low)

NE LAT, NE LON, SW LAT, SW LON - Northeast and Southwest corner coordinates of the region area

ZONE SIZE - in nautical miles

Updated at: Date and time tag of the regional parameters

Softkey Descriptions:



- softkey used to display information for the next region



- softkey used to display information for the previous region.



-request new regional parameters from the transponder.

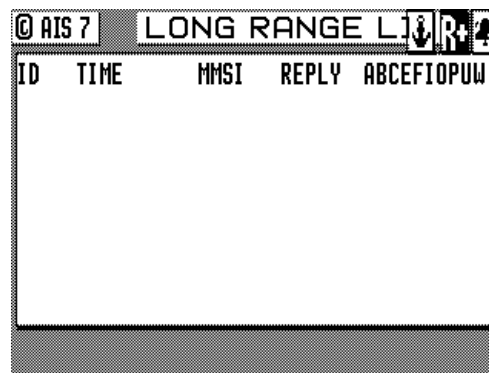
Note: The MX51x MKD will inform the operator if the zone size or delta Lat/Lon is too small. Also, the vessel's position must be within 500 NM of the region or the AIS will not accept the input.

5.2.7 AIS 7- LONG RANGE (LR) DISPLAY

This display shows a list of queries by other AIS stations going through the INMARSAT-C or other long-range communication systems. The MX51x can be set to respond to long-range interrogations either automatically, manually (default) or by external application.

When the setting is in AUTO, the MX51x will provide the requested information automatically. When in MANUAL, the operator needs to highlight the SEND REPLY softkey and press the **ENT** key to reply. The soft-keys can be brought up by pressing the **EDIT** key. Every time a long range query is received, the MX51x will pop-up a message window accompanied by an audio alarm. When in "Ext Appl" mode the external application will need to respond to the MX51x with permission to reply.

To look at the long-range list, press the AIS key several times until it shows the AIS 7 Long Range screen (as shown below).



ID	TIME	MMSI	REPLY	ABCEFIOPUW
----	------	------	-------	------------

Display Field Descriptions:

ID- Query index number (0-99)

TIME - Time when the long-range message was received (HH:MM)

MMSI- ID of requesting station

REPLY- YES-means the query has been answered

NO - means no reply has been sent yet

ABCEFIOPUW - an 'X' under each letter heading denotes the information requested in the interrogation message

Reply message description:

A - Ship's name, call sign and IMO number

B - Date and time of message composition

C - Position

E - Course over ground

F - Speed over ground

G - Destination and Estimate Time of Arrival (ETA)

H - Draught

I - Ship/Cargo type

J - Ship's length, breath, type

K - Persons on board

Softkey Descriptions:

Pressing the **EDIT** key will bring up the following softkeys:

NEXT
PAGE

This softkey is used to advance the display to show the next page of information.

This softkey is used to show the previous page of information.

PREV
SEND
REPLY

This softkey becomes available only when Long Range inquiry is received, otherwise it will not be there.

To reply to long-range interrogation in manual mode, do the following:

1. Press the **AIS** key several times until the AIS 7 screen appears.
2. Press the **EDIT** key to show the softkeys.
3. Highlight **SEND REPLY** softkey and press **ENT** key. A pop-up window requesting for an ID number will appear.
4. Enter the listed ID number to reply to.
5. Press **EDIT** key to exit.

5.2.8 AIS 9 – AIS STATUS

This display shows the operational status of the AIS transponder.

© AIS 9	AIS STATUS
AIS: External SOG/COG In Use	
AIS: External GNSS In Use	
AIS: External DGNSS In Use	
AIS: Backup GNSS In Use	
AIS: Backup SOG/COG In Use	

The table below is a list of possible AIS related messages generated by the transponder:

AIS Related Messages
AIS: UTC Clock Lost
AIS: Primary External DGNSS In Use
AIS: Primary External GNSS In Use
AIS: Backup DGNSS In Use (Beacon)
AIS: Backup DGNSS In Use (Msg 17)

AIS: Backup GNSS In Use
AIS: Backup SOG/COG in Use
AIS: HDG Data In Use
AIS: ROT Data In Use
AIS: Channel Management Parameters Changed
AIS: Secondary External DGPSNN In Use
AIS: Secondary External GPSNN In Use
AIS: Secondary External SOG/COG In Use
AIS: UTC Clock OK
AIS: Boot Sequence In Process

5.2.9 AIS 11

AIS 11 – Security Log

This AIS screen shows the list of Dates and Times the AIS transponder has been out of operation. Use the DOWN (or UP) arrow key to scroll through the list. Pressing the **EDIT** key will bring up the “REFRESH” softkey. Press the **ENT** key to refresh the screen.

© AIS 11		SECURITY LOG		↓ R ↑	
	Start Time	End Time	Cause		
1)	11/26/20 07:58	11/28/20 17:03	POW.		
2)	11/24/20 14:10	11/24/20 15:12	POW.		
3)	11/22/20 20:17	11/22/20 21:51	POW.		
4)	11/22/20 16:21	11/22/20 17:48	POW.		
5)	11/09/20 16:23	11/09/20 17:02	POW.		

5.2.10 AIS 12

AIS 12 - Remote Ship EPFS

This AIS screen indicates the MMSI, SRC (transmitted message type 1, 3 or 18), RNG (Range), EPFS (Electronic Position Fixing System) or source of position used by the target ships (i.e. GPS, GLONASS, etc.). Use the DOWN (or UP) arrow key to scroll through the list.

© AIS 12		REMOTE SHIP E				
TGT	MMSI	SRC	RNG	R	A	EPFS
25	△ 319009300	03	0.1NM	1		GPS
20	△ 372118000	03	4.7NM	1		GPS
01	△ 367049470	01	5.1NM	0		
08	△ 366926740	01	5.4NM	0		GPS
07	△ 366539000	01	5.4NM	1		
17	△ 366755010	03	5.4NM	1		
24	△ 366979360	01	5.5NM	1		

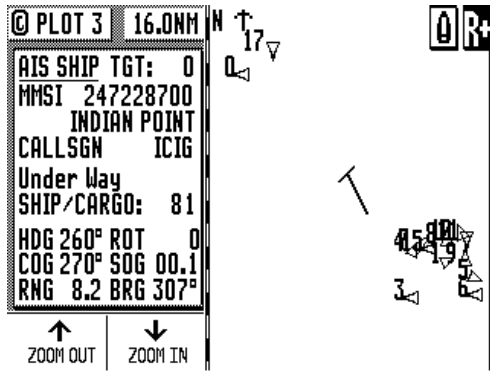
5.2.11 AIS 13

AIS 13 - Remote Ship Data

This AIS screen indicates the MMSI, RNG, Ship Dimensions (meters) and name of transponder manufacturer. Use the DOWN (or UP) arrow key to scroll through the list.

© AIS 13		REMOTE SHIP D				
TGT	MMSI	RNG	AAA	BBB	CC	DD Vendor ID
25	319009300	0.1NM				
03	538004117	4.6NM				
20	372118000	4.7NM	222	072	23	09M
00	209047000	4.8NM				
01	367049470	5.1NM				
17	366755010	5.4NM				
05	366539000	5.4NM				

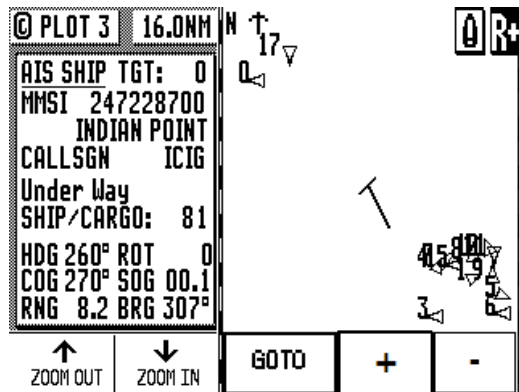
5.3 PLOT 3 Screen:



The PLOT 3 graphical display plots the positions of other AIS targets relative to your own position (center).

A vessel with neither a reported heading nor COG will be oriented toward the top of display area. The PLOT 3 screen is oriented as North Up only. You can change the zoom level using the UP or Down arrow keys. To zoom out use the UP arrow key. To zoom in, press the down arrow key.

To change the target vessel # use the procedure below:



1. Press the **EDIT** key. This will show several softkeys at the bottom of the screen.
2. Move the highlight using the left (or right) arrow key to GOTO and press the **ENT** key.
3. Specify the index number of the AIS target as shown next to the AIS icon targets in the PLOT 3 or listed in the AIS 2 screen. The data field will show the AIS parameters for that target chip.
4. You may also highlight the + (or -) then press the **ENT** key to sequentially bring up the data of available targets.
5. Press the **EDIT** key to exit.

Different types of targets are displayed with different icons

	Active Vessel If the CPA/TCPA system is activated, ships on collision course are displayed with a red color and double thickness of the lines. Own ship is indicated in the same way as other ships, but is always in center.
	Sleeping target Smaller symbol than “Active Vessel” without a beam line Sleeping targets are defined based on either: - Range more than X Nautical miles - Class B Activation can be either of the definitions above and can be visible or not.
	AIS base station
	A to N An Aid to navigation buoy indicating that it is off position is indicated with a red color.
	AIS SART. Will be displayed with a red color. AIS TEST will be displayed with normal color.
	SAR Aircraft
	Own ship

5.4 AIS Voyage Settings

Configuring the AIS Voyage

The **AIS Voyage** setting contains all the ship data to be entered or changed before or on each voyage. In order for the AIS system to function correctly, it is important to keep these parameters up to date. Information about the ship's destination, ETA time and date, number of passengers/crew and type of vessel are entered in the MX51x for each voyage or whenever needed.

CFG 1 AIS Voyage	
Item:	AIS Voyage Configuration:
AIS Config	Nav Stat: Moored
AIS Static	Destination:
AIS Voyage	ETA Time: 00:00
Alarms	ETA Date: Jan 1, 2010
Anchor	Draught: 20.0m
COG SOG	No of People: 5
Compass	Ship/Cargo Type: 30
Datum	Fishing Vessel
Depth	
DGPS	
ns	

AIS Voyage Parameter Descriptions:

Nav Stat - This setup item controls the AIS status icon shown on the upper-right corner of the display. See section below for all available nav-stat icons and descriptions.

Destination - Enter the 20-character destination name.

ETA Time - Enter the estimated time of arrival at the desired destination.

ETA Date - Enter the estimated date of arrival at the desired destination.

Draught - Enter draught height in meters.

No. of People - Enter the number of people on board (1-8191).

Ship/Cargo Type - Use the softkey to toggle ship cargo choices. Refer to table A.2 for possible ship type values (0-255).

Softkey Descriptions:



- Use the **CHANGE** softkey to toggle through various values available in the field.



-Use the **SEND PEOPLE** softkey to send the broadcast the number of people on-board.

Navigation Status Icons and Descriptions:



Vessel underway



Not Defined



Vessel not commanded, limited maneuverability, limited by draught, aground or reserved for future use



Ship is anchored or moored



The MX51x display is not communicating with the MX535B transponder.

Note: The displayed icons located on the top-right corner of the screen is set to blink off and on every 3 seconds to allow the operator to see what is behind it and is not considered an alarm condition. An every second blinking is an alarm condition.

To change the AIS Voyage settings, do the following:

1. Press the **CFG** key.
2. Scroll down to AIS Voyage menu.
3. Press the **EDIT** key to bring up the cursor on the right box.
4. Scroll to the item you want to change.
5. Using the left (or right) arrow key to move the softkey highlight to the CHANGE softkey.
6. Press the **ENT** key to activate the CHANGE softkey to parse through the available settings or use the alphanumeric keypad to enter name of place or numbers.
7. Press the **EDIT** key to accept entry and exit.

Note: Normal VHF transmission power is 12.5 Watts. Low Power is 1 Watt if Vessel type selected is "Tanker", Speed is below 3 knots and Navigation Status is "Moored".

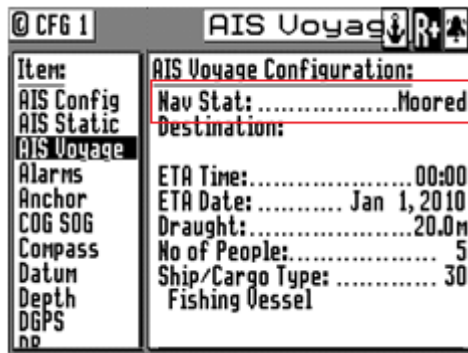
5.4.1 Table for ID Numbers

Table A.2 ID Numbers Used in AIS

Identifier No.	Special craft		
50	Pilot Vessel		
51	Search and rescue vessel		
52	Tugs		
53	Port tenders		
54	Vessels with anti-pollution facilities or equipment		
55	Law enforcement vessels		
56	Spare – for assignments to local vessel		
57	Spare – for assignment to local vessel		
58	Medical transports (as defined in the 1949 Geneva Conventions and Additional Protocols)		
59	Ships according to Resolution No. 18 (Mob-8.3)		
Other Ships			
First digit (*)	Second Digit (*)	First digit (*)	Second digit (*)
1-reserved for future use	0-All ships on the type	-	0-Fishing
2-WIG	1-Carrying DG, HS, or MP IMO hazard of pollutant category A.	-	1-Towing
3-see right column	2-Carrying DG, HS, or MP IMO hazard or pollutant category ,	3-vessel	2-Towing and length of the tow exceeds 200m or breadth exceeds 25m
4-HSC	3-Carrying DG, HS, MP IMO hazard or pollutant	-	3-Engaged in dredging or underwater operations.
5-see above	4-Carrying DG, HS, or MP IMO hazard or pollutant category C.	-	4-Engaged in diving operations
	5-reserved for future use	-	5-Engaged in Military Operations
6-Passenger ships	6-reserved for Future use	-	6-Sailing
7- Cargo ships	7-reserved for Future use	-	7-Pleasure craft
8-Tankers	8-reserved for Future use	-	8-reserved for future use
9-Other types of ships	9-No additional information	-	9-reserved for future use
DG: Dangerous Goods HS: Harmful Substances MP: Marine Pollutants (*) Note: The identifier should be constructed by selecting the appropriate first and second digit			

5.4.2 Navigational Status

The options available for the navigational status are as follows:



Vessel not under command means a vessel which through some exceptional circumstance is unable to maneuver as required by these Rules and is therefore unable to keep out of the way of another vessel.

Vessel restricted in her ability to manoeuver means a vessel which from the nature of her work is restricted in her ability to maneuver as required by these Rules and is therefore unable to keep out of the way of another vessel. The term “vessels restricted in their ability to maneuver” shall include but not be limited to:

- A vessel engaged in laying, servicing or picking up a navigation mark, submarine cable or pipeline;
- A vessel engaged in dredging, surveying or underwater operations;
- A vessel engaged in replenishment or transferring persons, provisions or cargo while underway;
- A vessel engaged in the launching or recovery of aircraft;
- A vessel engaged in mine clearance operations;
- A vessel engaged in a towing operation such as severely restricts the towing vessel and her tow in their ability to deviate from their course.

Vessel constrained by her draught means a power-driven vessel which, because of her draught in relation to the available depth and width of navigable water, is severely restricted in her ability to deviate from the course she is following.

Fishing means any vessel fishing with nets, lines, trawls or other fishing apparatus which restrict maneuverability, but does not include vessel fishing with trolling lines or other fishing apparatus which do not restrict maneuverability.

Sailing means vessel under sail provided that propelling machinery, if fitted, is not being used.

Under way means vessel is moving under power.

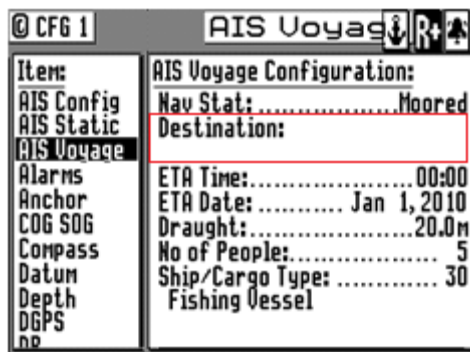
Moored or Anchored is used when the vessel is anchored or tied at the dock.

Not Defined (Default) is used when MX535B is delivered from factory. Then none of above selections is made.

5.4.3 Destination

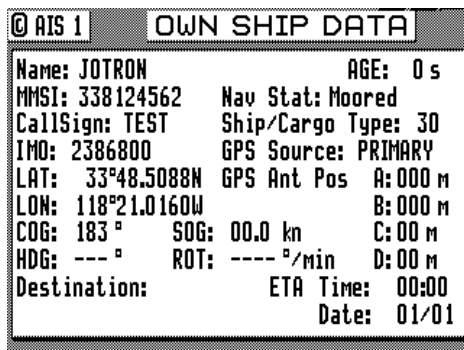
The destination of the voyage is to be entered here using a maximum of 20 characters.

Use the alpha-numeric keypad to enter the destination name:



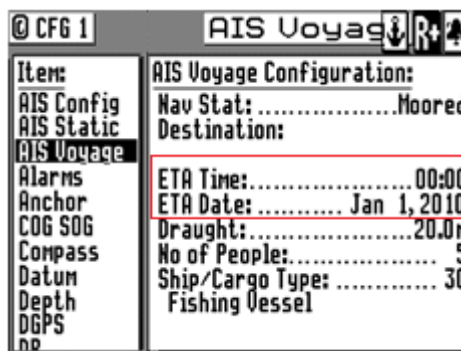
1. Press the **CFG** key.
2. Scroll down to AIS Voyage menu.
3. Press the **EDIT** key.
4. Scroll down to Destination field.
5. Using the alphanumeric keypad, spell the destination name.
6. Scroll down to other field to change the ETA time, ETA date, etc.
7. Press the **EDIT** key to exit.

You can verify the changed voyage data by pressing the AIS key to bring up AIS1 screen.



5.4.4 ETA

The Estimated Time and Date of Arrival are displayed to other AIS units and should be updated if the expected schedule is changed.



5.4.5 Persons Aboard (optional)

This parameter indicates the number of persons aboard the ship at the given moment.

This parameter is not sent to other ships or base stations, only through the Long Range Port which is normally not used (in 2011).

CFG 1 AIS Voyage	
Item:	AIS Voyage Configuration:
AIS Config	Nav Stat: Moored
AIS Static	Destination:
AIS Voyage	ETA Time: 00:00
Alarms	ETA Date: Jan 1, 2010
Anchor	Draught: 20.0m
COG SOG	No of People: 5
Compass	Ship/Cargo Type: 30
Datum	Fishing Vessel
Depth	
DGPS	
DR	

5.4.6 Cargo Category

Identifies the type of cargo, depending on the ship class.
See Table on page 36 for reference.

CFG 1 AIS Voyage	
Item:	AIS Voyage Configuration:
AIS Config	Nav Stat: Moored
AIS Static	Destination:
AIS Voyage	ETA Time: 00:00
Alarms	ETA Date: Jan 1, 2010
Anchor	Draught: 20.0m
COG SOG	No of People: 5
Compass	Ship/Cargo Type: 30
Datum	Fishing Vessel
Depth	
DGPS	
DR	

5.4.7 Draught

The Draught parameter specifies the maximum depth of the ship in meters.

CFG 1 AIS Voyage	
Item:	AIS Voyage Configuration:
AIS Config	Nav Stat: Moored
AIS Static	Destination:
AIS Voyage	ETA Time: 00:00
Alarms	ETA Date: Jan 1, 2010
Anchor	Draught: 20.0m
COG SOG	No of People: 5
Compass	Ship/Cargo Type: 30
Datum	Fishing Vessel
Depth	
DGPS	
DR	

6 Installation

6.1 Mechanical Mounting

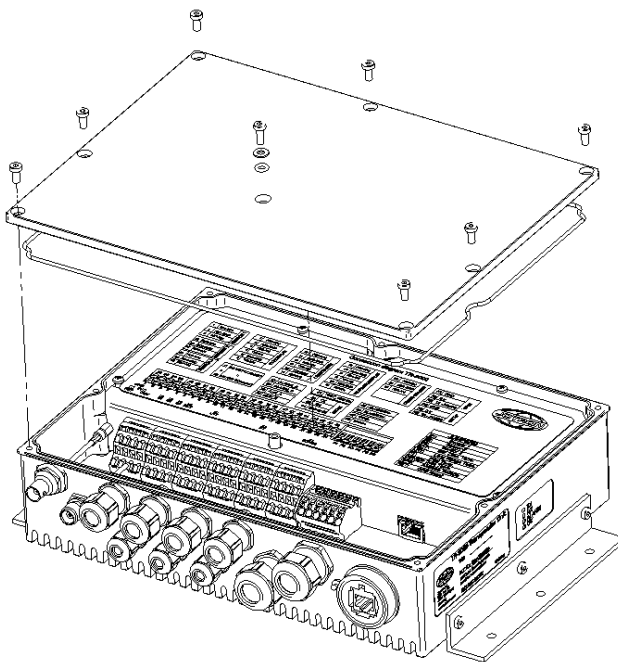
6.1.1 Transponder unit

Use the standard Mounting Kit. For dimensions and positioning of holes see *Figure 14-1 MX535B Transponder Unit- mechanical dimensions*.

When selecting a mounting location for the Transponder the following guidelines apply:

1. Keep the transponder out of direct sunlight.
2. Do not mount the transponder where it can be directly exposed to seawater as corrosion then may appear and cause leakage.
3. The unit must not be mounted near exhaust pipes and vents.
4. Even though the transponder is a robust unit, it is advised that it should be mounted where shock and vibration are minimal.
5. Unit shall not be located near electromagnetic field generating equipment.
6. Leave sufficient space at the sides and top of the unit for maintenance and repair.
Also leave slack in cables for the same reason.
7. Do not mount transponder unit too close to a magnetic compass:

Compass safe distance:	Standard Compass:	95 cm
	Steering Compass:	65 cm



The MX535B transponder unit can be mounted in all directions, either on a wall, roof or floor. The unit is very robust and made of cast aluminum coated with black paint for best type of protection.

For detailed mechanical drawings, see chapter 12, "Outline Drawings".

Figure 6.1 Transponder Unit, exploded view. Opening of outer lid.

6.1.2 MX51X Display Unit

The display unit can be installed as bracket mounted or flush mounted in a panel. Installation shall be near the conning position.

When selecting a mounting location for the Display Unit the following guidelines apply:

1. Do not mount the display unit where it can be directly exposed to seawater as corrosion then may appear and cause leakage.
2. The unit must not be mounted near exhaust pipes and vents.
3. Even though the transponder is a robust unit, it is advised that it should be mounted where shock and vibration are minimal.
4. Unit shall not be located near electromagnetic field generating equipment
5. Leave sufficient space at the back for connection to necessary cables.
6. Do not mount transponder unit too close to a magnetic compass:

Compass safe distance:	Standard Compass:	30 cm
	Steering Compass:	14 cm

6.1.2.1 Bracket Mounting

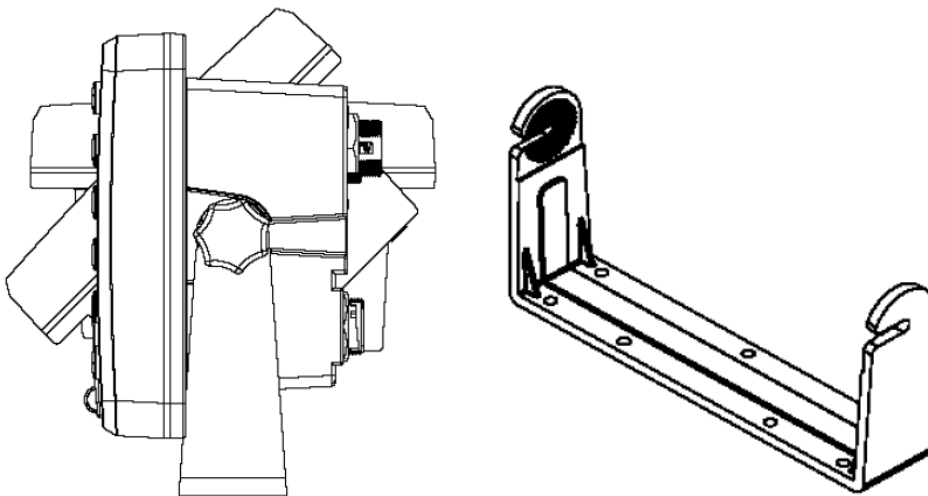


Figure 6.2 Bracket mounted MX51x display unit and bracket mount

When display unit is mounted overhead, it might be necessary to adjust Contrast. This can be done by using the procedure below:

1. Press the **CFG** key.
2. Scroll down to "Lighting" menu.
3. Press the **EDIT** key.
4. Change the contrast by using the left or right arrow keys.
5. Press the **EDIT** key to exit.

For detailed mechanical drawings, see chapter **12 Outline Drawings**.

6.1.2.2 Flush/ Panel Mounting

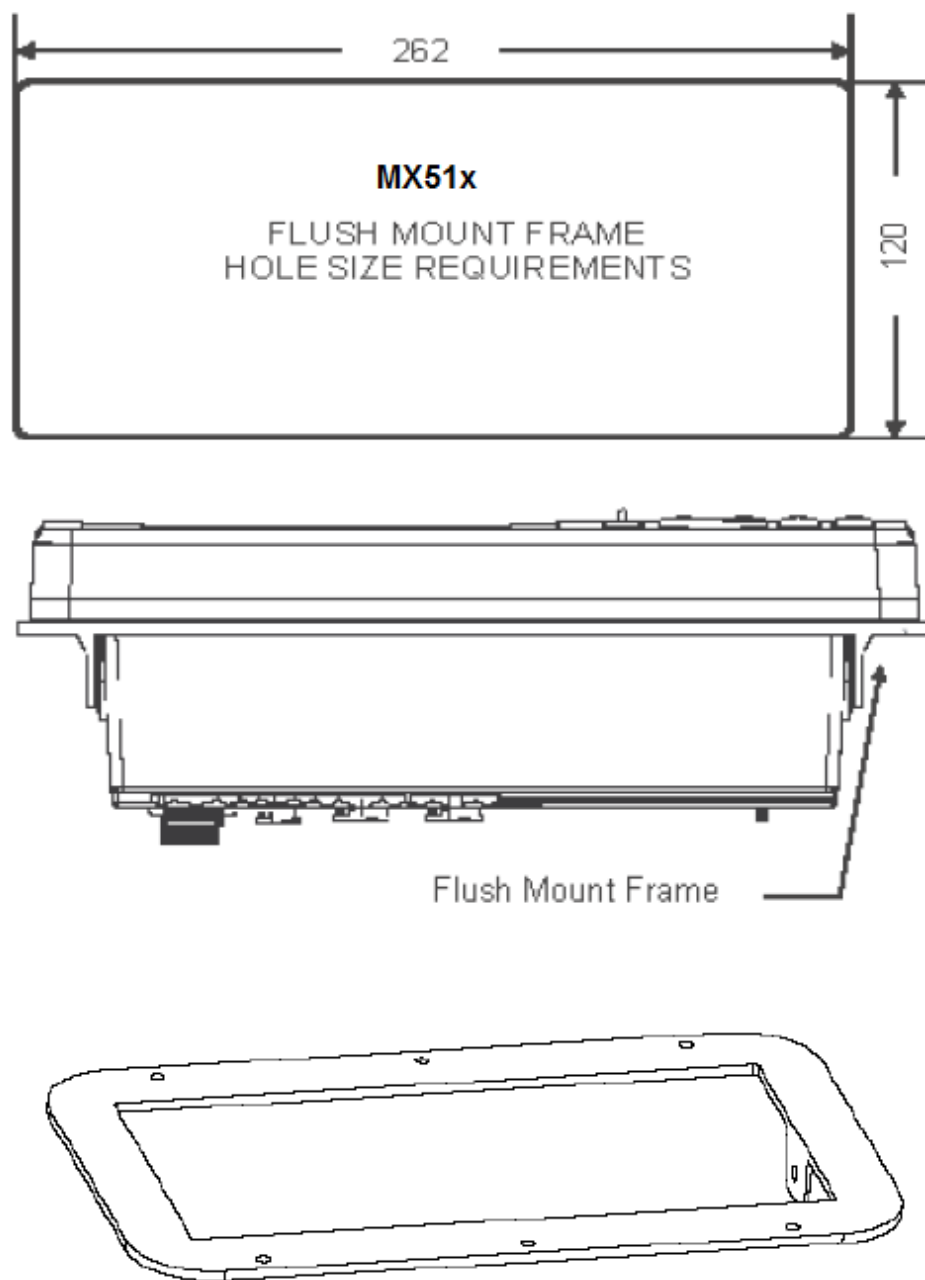


Figure 6.3 Flush mount requirement and flush mount frame

6.1.3 Antennas

As a general rule, longer horizontal distances to other antennas will minimize the interference and improve reception on all antennas.

Minimum distance is described in the figures below:

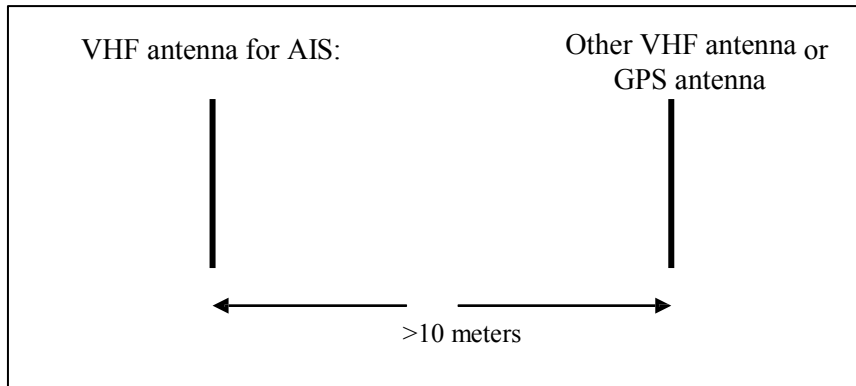


Figure 6.4 Horizontal separation distance.

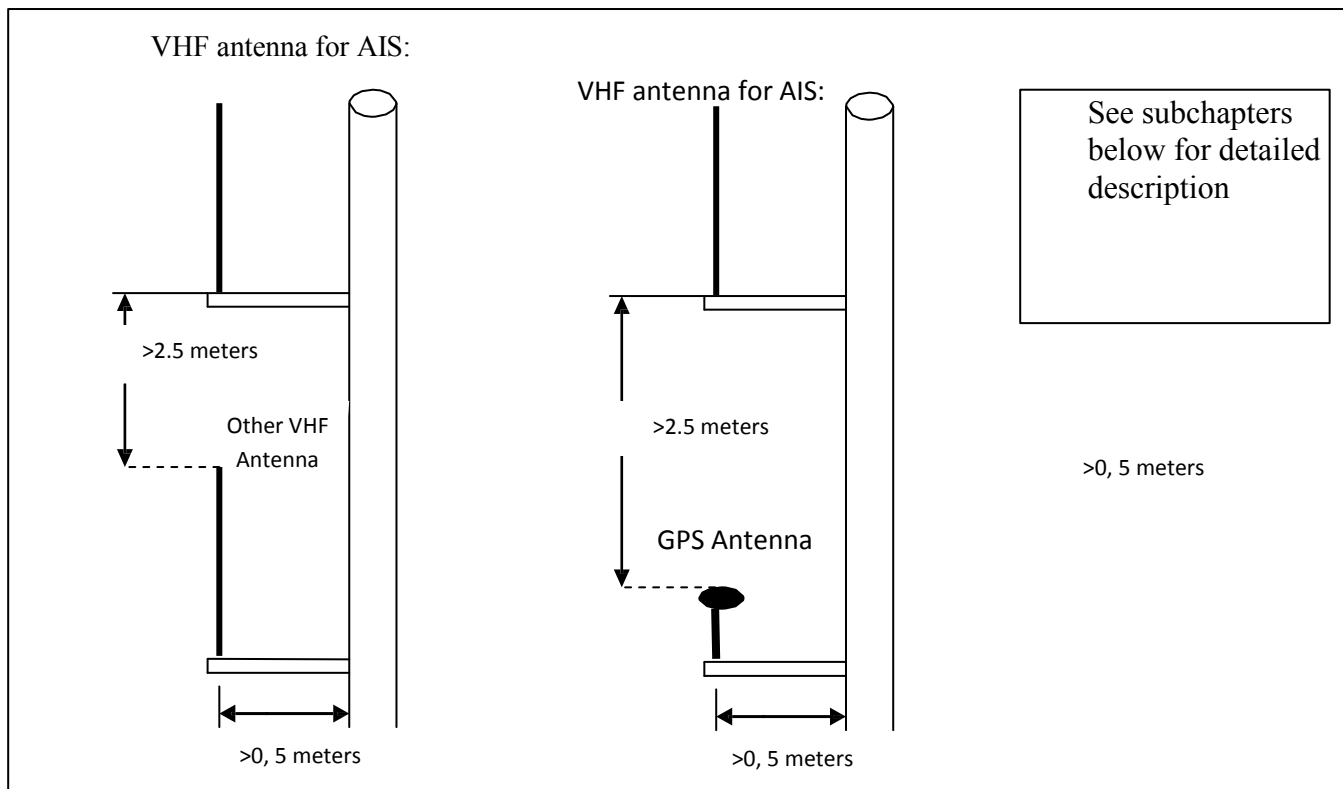


Figure 6.5 Vertical separation and distance from mast or other object of metal. For best isolation between antennas, place directly underneath with no horizontal separation.

6.1.3.1 GPS Antenna

When selecting a mounting location for the antenna, keep in mind the following points.

1. Select a location out of the radar beam. The radar beam will obstruct or prevent reception of the GPS satellite signal.
2. There should be no interfering object within the line-of-sight to the satellites. Objects within the line-of-sight to a satellite, for example a mast, may block reception or prolong acquisition time.
3. Mount the antenna unit as high as possible to keep it free of interfering objects and water spray, which can interrupt reception of GPS satellite signal if the water freezes.

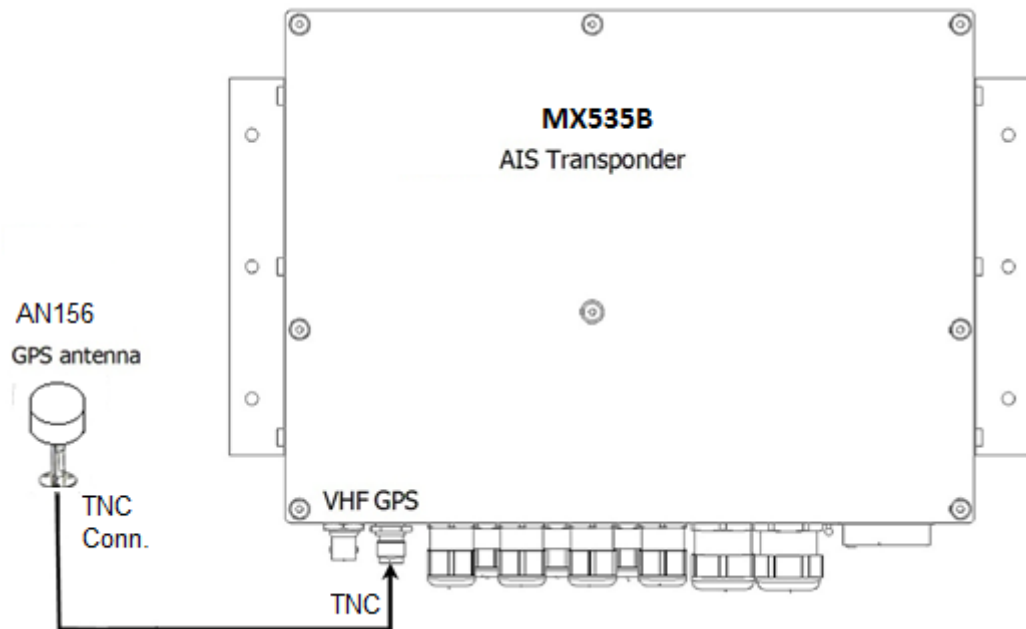
6.1.3.1.1 GPS Globe Antenna



MX535B is delivered as standard with GPS globe antenna (P/N AN156). The stainless steel stand and antenna coax cable with TNC connectors in both ends for direct connection between transponder and antenna are not included in the kit.

The antenna mount is 1"-14 TPI standard mounting.

Outline Drawings

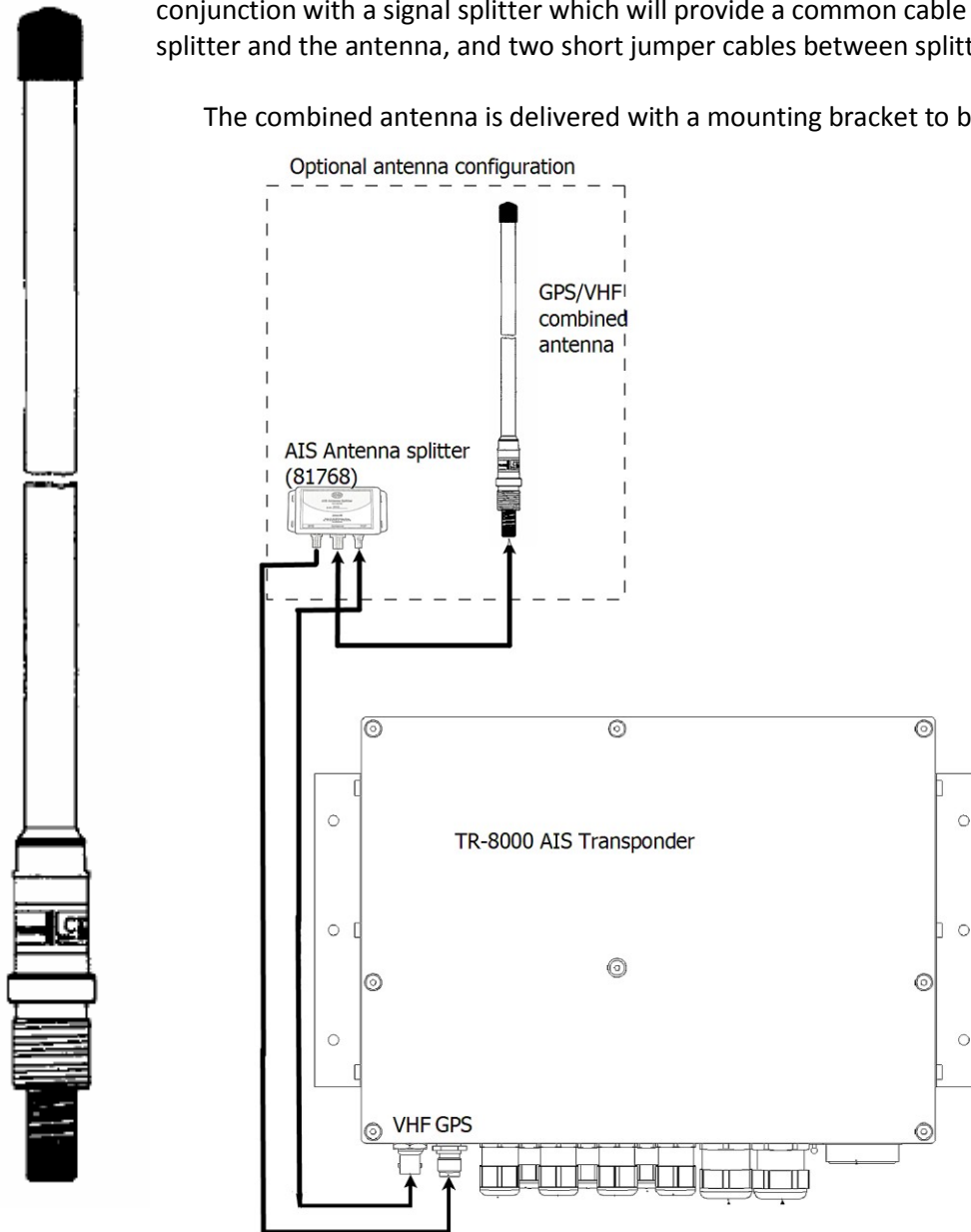


Calculation of cable length/attenuation etc... is described in chapter 6.2

6.1.3.1.2 Combined VHF/AIS

As an option to the individual VHF and GPS antennas, a combined antenna may be used in conjunction with a signal splitter which will provide a common cable between the signal splitter and the antenna, and two short jumper cables between splitter and transponder.

The combined antenna is delivered with a mounting bracket to be mounted on a mast.



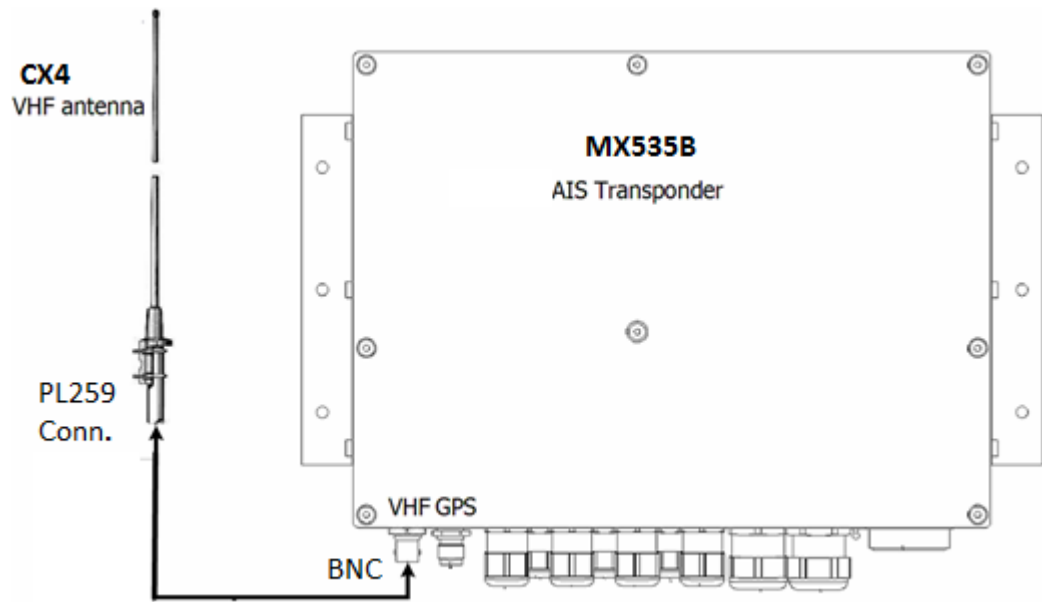
Calculation of cable length/attenuation etc... is described in chapter 6.2

6.1.3.2 VHF Antenna



When individual GPS antenna is used, the CX4 VHF antenna must also be connected.

Location of the mandatory AIS VHF-antenna should be carefully considered. Digital communication is more sensitive than analogue/voice communication to interference created by reflections in obstructions like masts and booms. It may be necessary to relocate the VHF radiotelephone antenna to minimize interference effects. Install the VHF antenna referring to drawings in beginning of this chapter



The antenna should be connected using RG214 cable or better using BNC connector on the transponder end and PL259 connector on the antenna end.

Calculation of cable length/attenuation etc... is described in chapter 6.2

6.2 Cabling

All outdoor installed connectors on coaxial cables should be fitted with preventive isolation such as vulcanizing tape to protect against water penetration into the antenna cable.

Coaxial cables should be installed in separate signal cable channels/tubes and at least 10 cm away from power supply cables. Crossing of cables should be done at right angles (90°). The minimum bend radius of the coaxial cable should be 5 times the cable's outer diameter.

The cables should be kept as short as possible to minimize signal attenuation.

The type of cables used onboard vessels should be:

- Halogen free
- Fire resistant or Flame retardant type
- Low smoke

6.2.1 GPS antenna

The table below gives recommendations on cables that can be used for the GPS antenna connections:

Type	Attenuation @1.5 GHz (dB/100 m)	Remark
RG58	90	Default for use if length < 20 m and antenna = AN156
RG214	35	If combined GPS/VHF antenna from either AC-Marine, Procom or Comrod is used, this or better can be used
RG225	30	Cable with lower loss recommended for cable runs >30 meters

For optimum performance of the transponder approximately +10 dB gain should be available when the cable attenuation has been subtracted from the GPS antenna preamplifier gain. Note that Procom AIS2/GPS and Comrod AC17-AIS are combined VHF/GPS antennas and additional attenuation from connectors / diplexer must be taken in consideration. Some examples below:

Cable Type	Antenna	Preamplifier Gain (dB/100 m)	Recommended cable length (m)
RG58	AN156	30	<20
RG214	AN156	28	10-30
	Comrod AC17-AIS	20	10-20
	AC Marine VHF/GPS-B	18	10-20
RG225	AN156	28	10-40
	Comrod AC17-AIS	20	10-30
	AC Marine VHF/GPS-B	18	10-30

6.3 Wiring and Connections

The table below shows the attenuation on the VHF frequencies with different cable types:

Cable Type	Attenuation @150 MHz (dB/100 m)	Diameter (mm)	Weight (kg/100 m)
RG214	7	10.8	18.5
RG225	8	10.9	23.3

Example: A RG 214 cable with length of 40 meters will have an attenuation of 2.8 dB.

Please keep the cables as short as possible, and be aware that 3 dB losses mean only half the output power. If you have a transmitter delivering 12.5 W, and you have 3 dB losses in the cable, only 6.25 Watts will be at the antenna.

6.3.1 Cable between MX535B Transponder and MX51x Display Unit

The cable connecting the MX535B Transponder and the MX51x Display unit is a double twisted-pair cable with individual shielding. Connections to the MX51x can be done easily through the junction box terminals as shown below for the MX512 and MX510 display models.

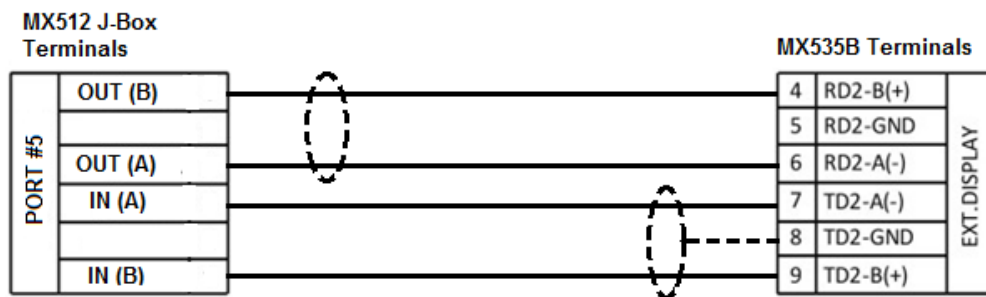


Figure 6.6 Wiring diagram between the Transponder and the MX512 Display Unit (port 5)

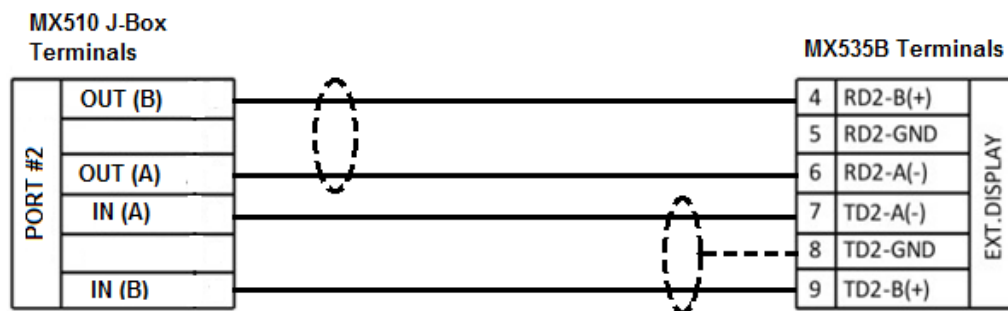


Figure 6.7 Wiring diagram between the Transponder and the MX510 Display Unit (port 2)

6.3.2 Wiring Figure

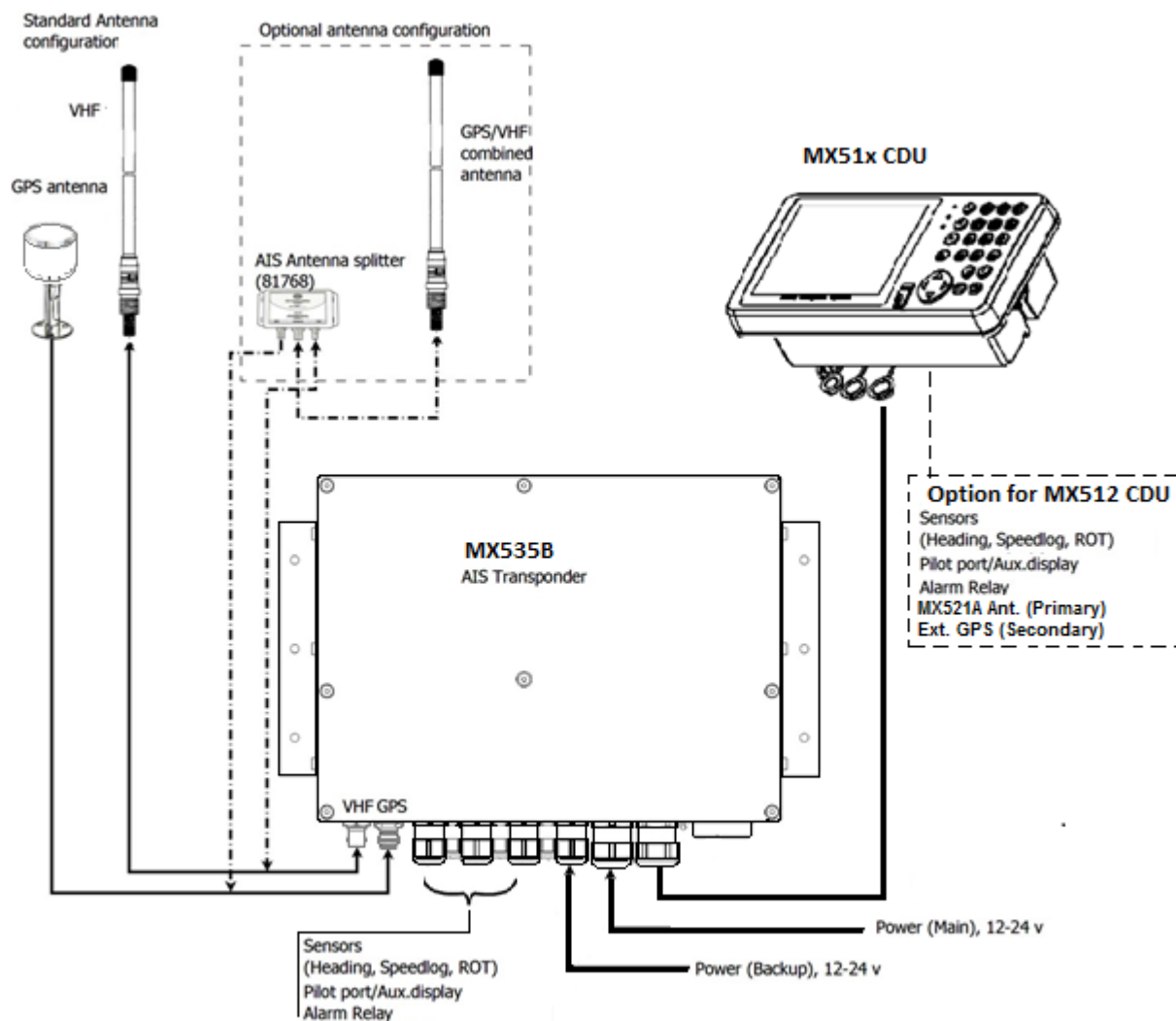


Figure 6.8 Block diagram of typical connections

Wiring and connection of Antennas (GPS + VHF) are described in chapter 6.1.3

6.3.3 Transponder

In order to connect all sensors and external connections to the Transponder Unit, the lid must be removed by removing the screws on top of the unit. Pay attention to the seal gasket on the inside of the lid and the small O-ring positioned on the center screw. These gaskets need to be in place when mounted in order to keep the unit waterproof. When the lid is off, the connections to sensors, ECS etc... can be made. The inner lid shall not be removed by user.

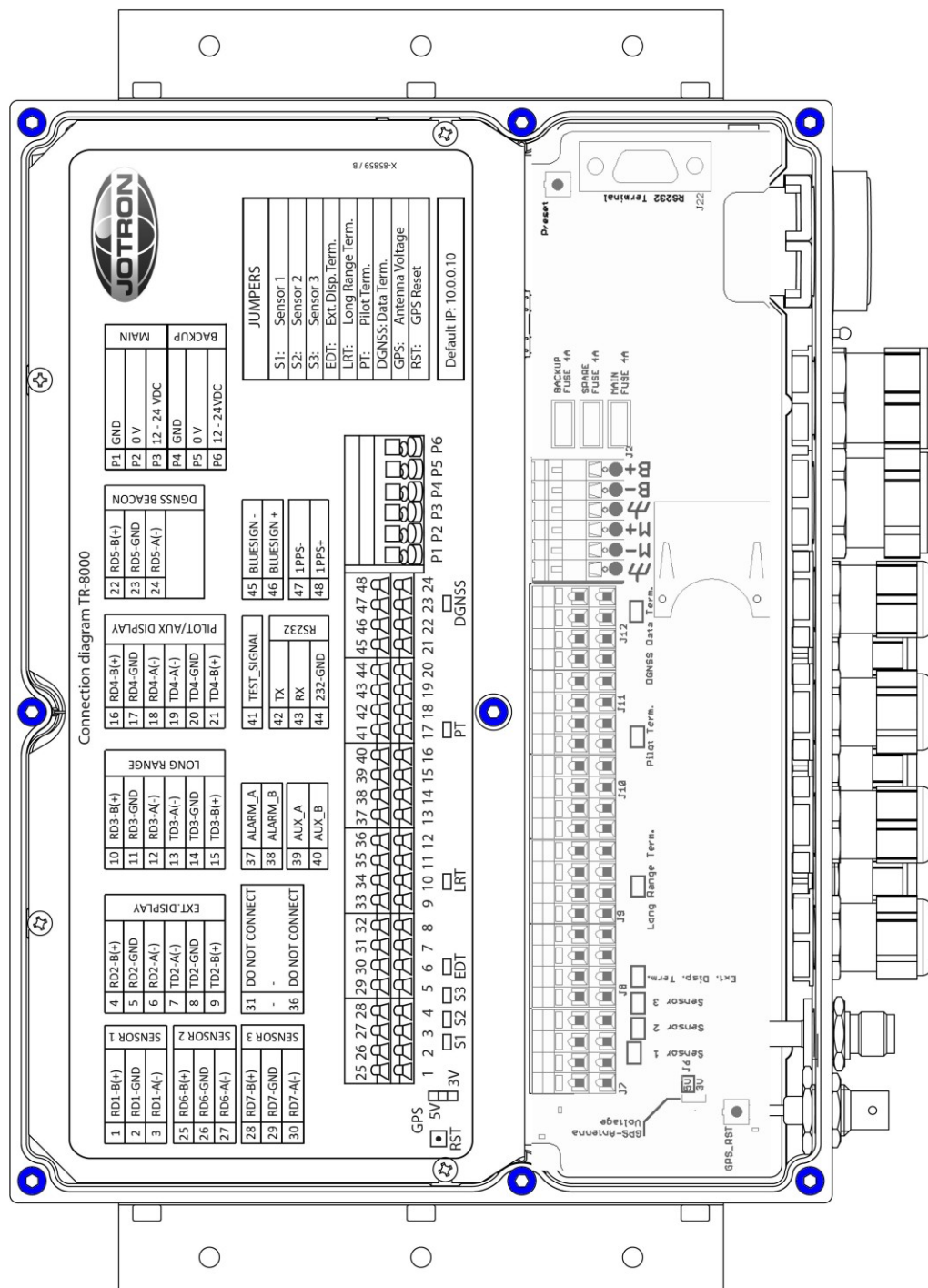


Figure 6.9 Transponder with lid removed, lid screws highlighted

6.3.4 Pictorial display of typical connections to the transponder

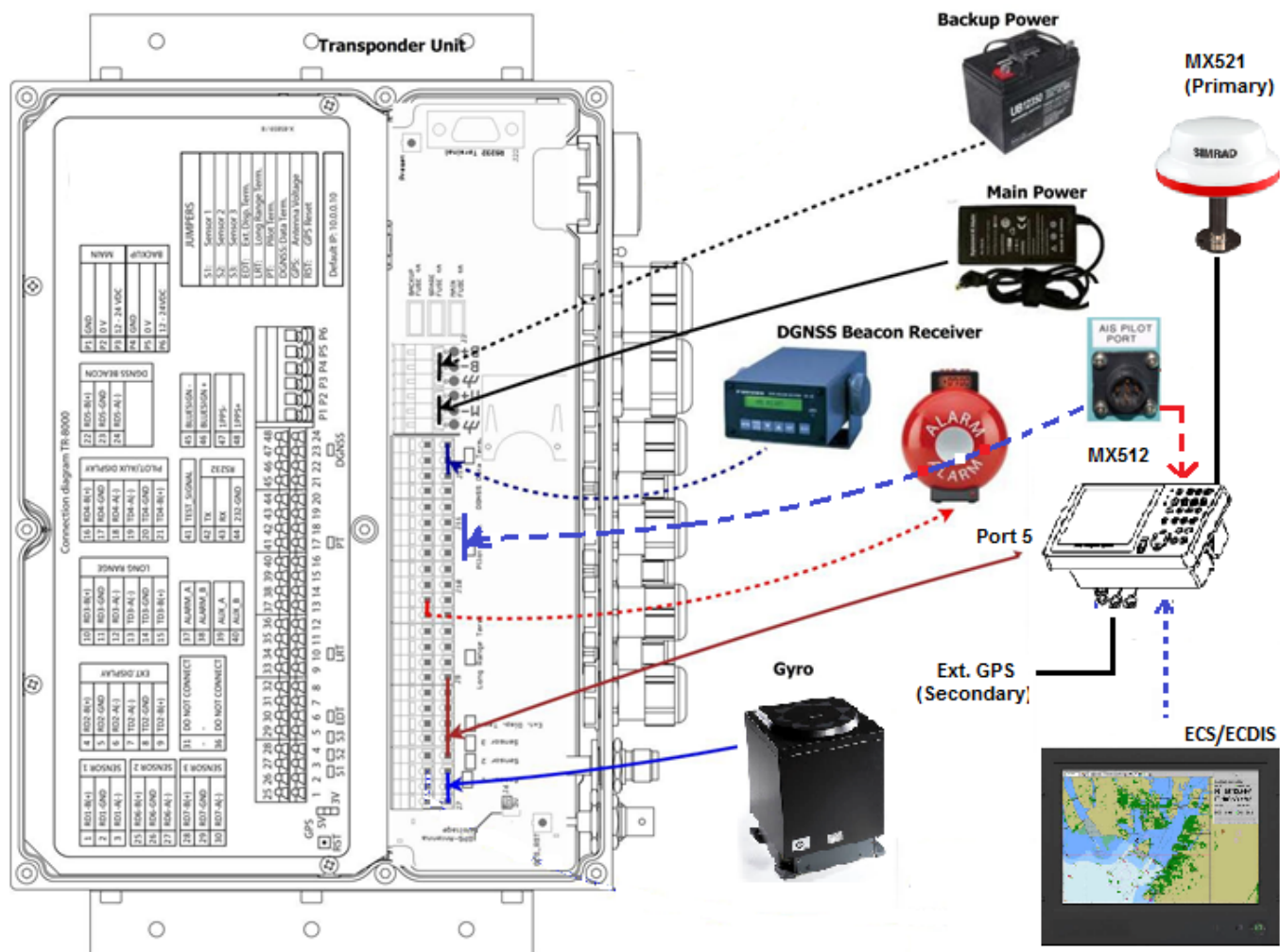


Figure 6.10A: MX512 to MX535B transponder, dashed lines show options

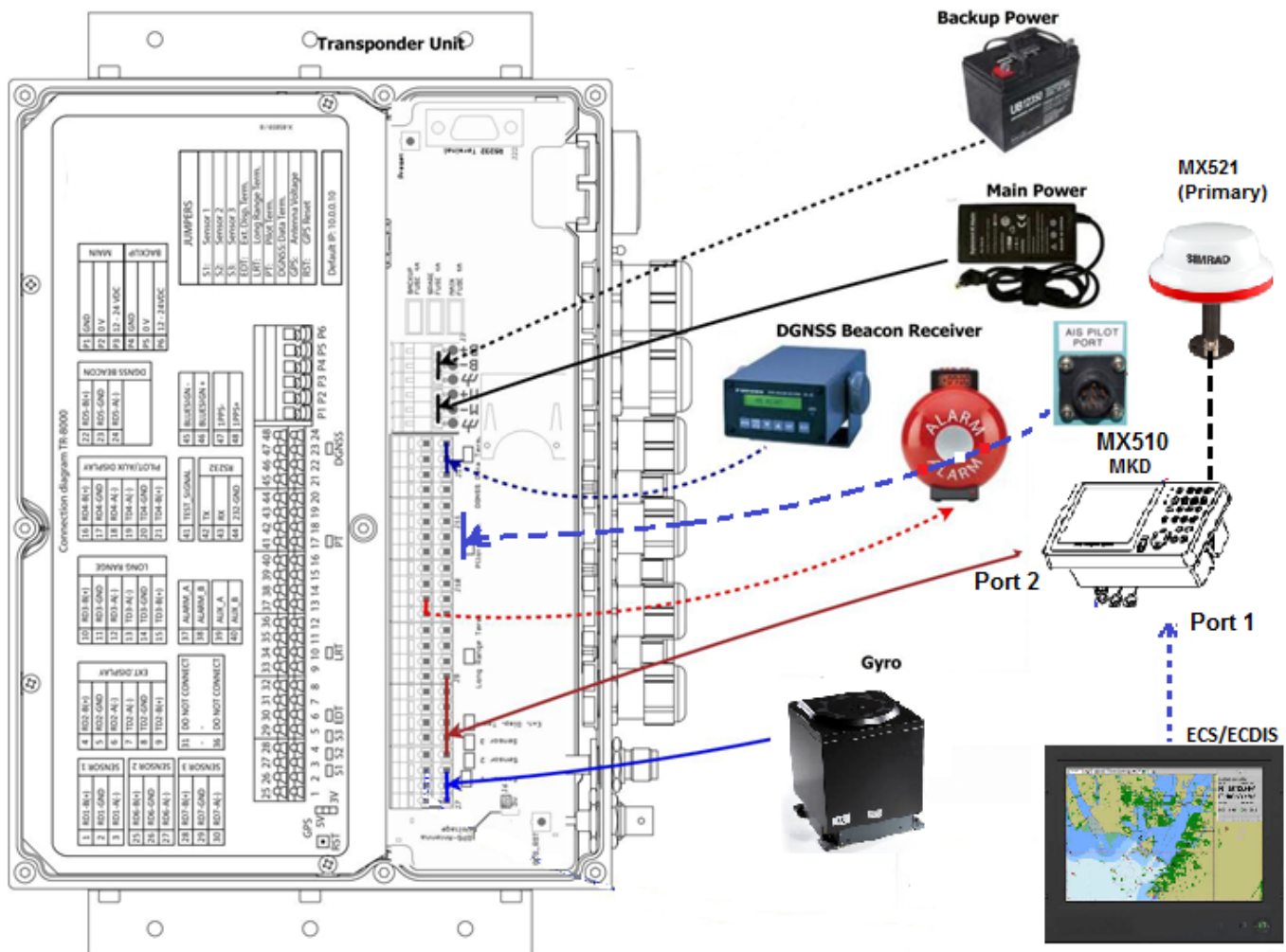
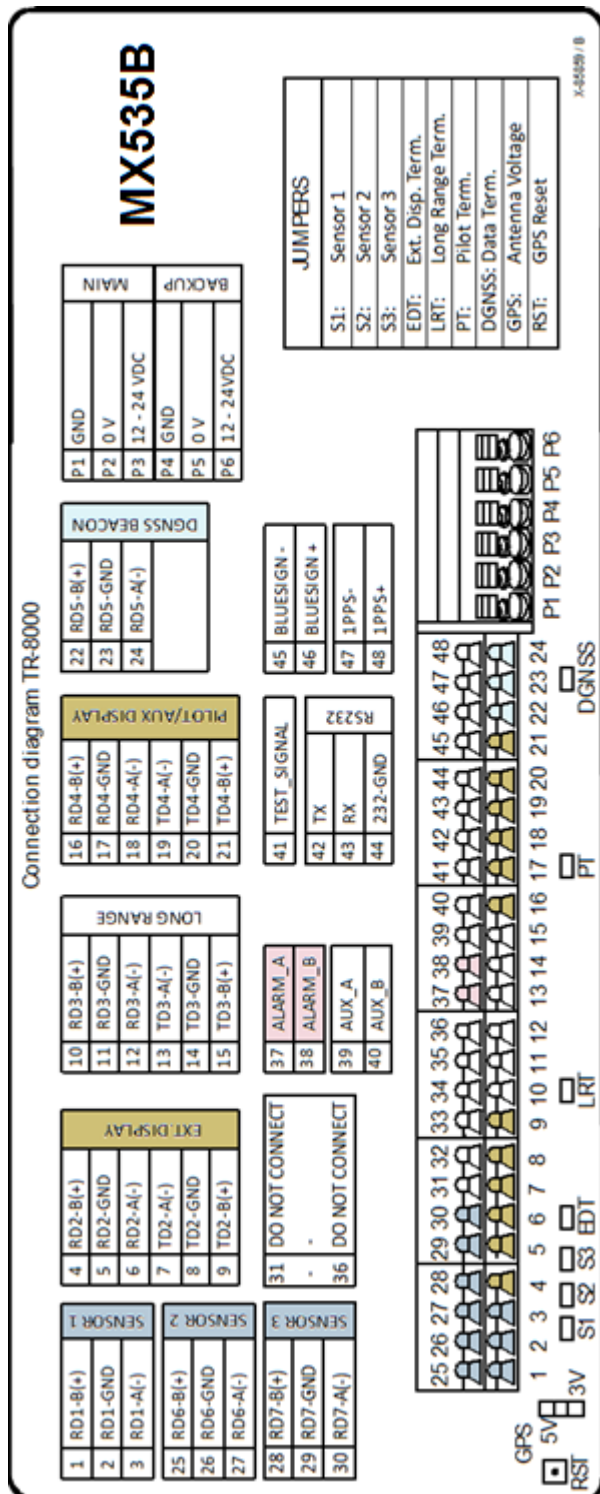


Figure 6.10B: MX510 to MX535B transponder connection, dashed lines shows options

6.3.5 Label in transponder with connection tables

Label:



Connections table (Except power):

#	In / Out	Type	Usage	Name
1	In	IEC61162-1 (RS422)	Sensor 1 (GPS)	RD1-B (+)
2				RD1-GND (Iso Gnd)
3	In			RD1-A (-)
4	In	IEC61162-2 (RS422)	MX51x Display	RD2-B (+)
5				RD2-GND (Iso Gnd)
6	In			RD2-A (-)
7	Out			TD2-A (-)
8				TD2-GND (Iso Gnd)
9	Out			TD2-B (+)
10	In	IEC61162-2 (RS422)	Long Range	RD3-B (+)
11				RD3-GND (Iso Gnd)
12	In			RD3-A (-)
13	Out			TD3-A (-)
14				TD3-GND (Iso Gnd)
15	Out			TD3-B (+)
16	In	IEC61162-2 (RS422)	Pilot / Aux Display	RD4-B (+)
17				RD4-GND (Iso Gnd)
18	In			RD4-A (-)
19	Out			TD4-A (-)
20				TD4-GND (Iso Gnd)
21	Out			TD4-B (+)
22	In	IEC61162-1 (RS422)	DGNSS Beacon	RD5-B (+)
23				RD5-GND (Iso Gnd)
24	In			RD5-A (-)
25	In	IEC61162-1 (RS422)	Sensor 2 (GYRO)	RD6-B (+)
26				RD6-GND (Iso Gnd)
27	In	IEC61162-1 (RS422)	Sensor 3	RD6-A (-)
28	In			RD7-B (+)
29				RD7-GND (Iso Gnd)
30	In			RD7-A (-)
31-36	NC			
37	Out	Relay (NO)	Alarm	ALARM_A
38	Out			ALARM_B
39	Out	Relay (NO)	Auxiliary Relay	AUX_A (Don't connect)
40	Out			AUX_B (---)
41	NC	Test signal	Test signal	(not isolated)
42	Out	RS232C	RS232	TX (Transmit)
43	In			RX (Receive)
44				232-GND (Ground)
45	In	Optoisolated (Connect + And - for Activation)	Blue sign	BLUESIGN - (Inland functionality)
46	In			BLUESIGN + (---)
47	In	(---)	1PPS	1PPS- (Don't connect)
48	In			1PPS+ (---)

Figure 6.11 Label inside transponder with corresponding table showing details about each connection. It is colored to differentiate sensors, display/pilot, alarm and DGNSS beacon interface

6.3.6 Power Connection

Table showing connection of main and backup power - See also Figure 8-10

Connection	Function
P1	GND (Chassis)
P2	MAIN 0 V
P3	MAIN 12 - 24 VDC
P4	GND (Chassis)
P5	BACKUP 0 V
P6	BACKUP 12 - 24 VDC

Allowed voltage levels of the power supply to be connected with the transponder:

Minimum = 10.8 Volt and Maximum = 31.2 Volt

Recommended cable diameter: 2.5 – 4 mm²

6.3.7 Sensor Connections

Sensors like GPS, Gyro, Speed log etc... may be connected to the 3 different sensor inputs in the MX535B Transponder unit.

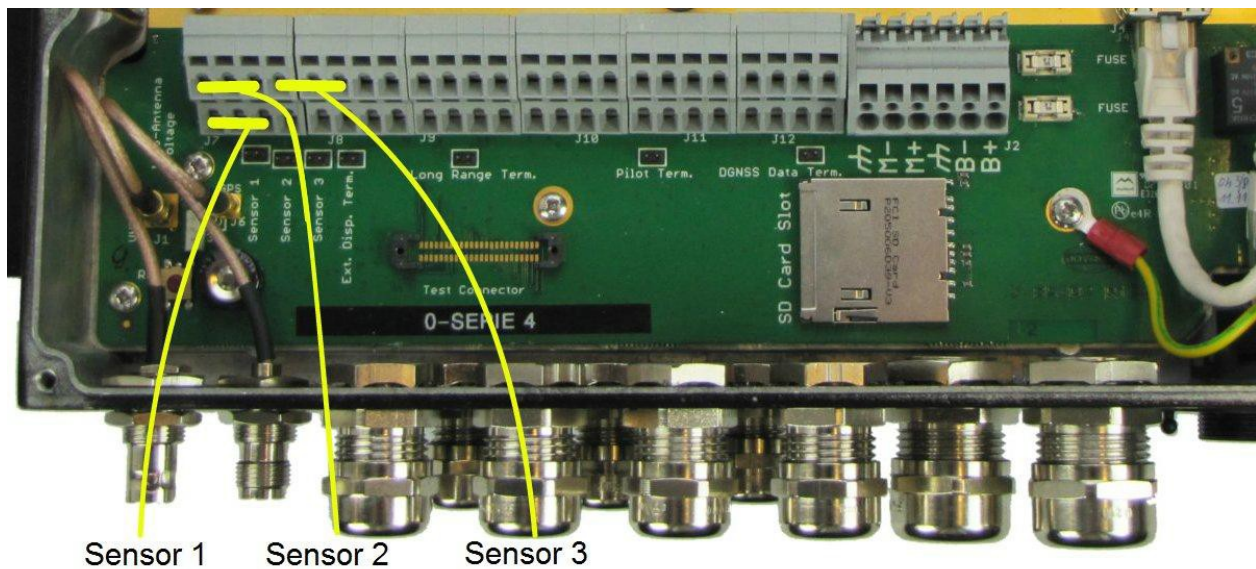


Figure 6.12 Sensor Terminals

Recommended cable diameter: 0.25 - 2.5 mm²

#	In/Out	Type	Usage	Name
1	In	IEC61162-1 (RS422)	Sensor 1	RD1-B(+)
2				RD1 -GND (Iso Gnd)
3	In			RD1-A(-)
25	In	IEC61162-1 (RS422)	Sensor 2	RD6-B (+)
26				RD6-GND (Iso Gnd)
27	In			RD6-A (-)
28	In	IEC61162-1 (RS422)	Sensor 3	RD7-B (+)
29				RD7-GND (Iso Gnd)
30	In			RD7-A (-)

6.3.8 External display – ECDIS/Radar connections

The MX535B have a very flexible solution when it comes to connecting ECS/ECDIS, Modern Radar or Chart plotter for displaying AIS data on a more advanced display than the MX51x Display unit, which only gives you basic text/graphic information.

On modern ECS, Radars, Chart plotters etc. the vessels received by the MX535B will be shown as a separate “Layer” or “Overlay” with configurable alarms on collision probability (CPA/TCPA) together with high resolution accurate charts.

The MX535B Transponder unit can be connected in three different ways:

1. RS422 (Default), connections 4-9
2. RS232, connections 42-44
3. Ethernet (UDP), connected either instead of the MX535B display unit, or together with a network Switch in parallel with the Display Unit

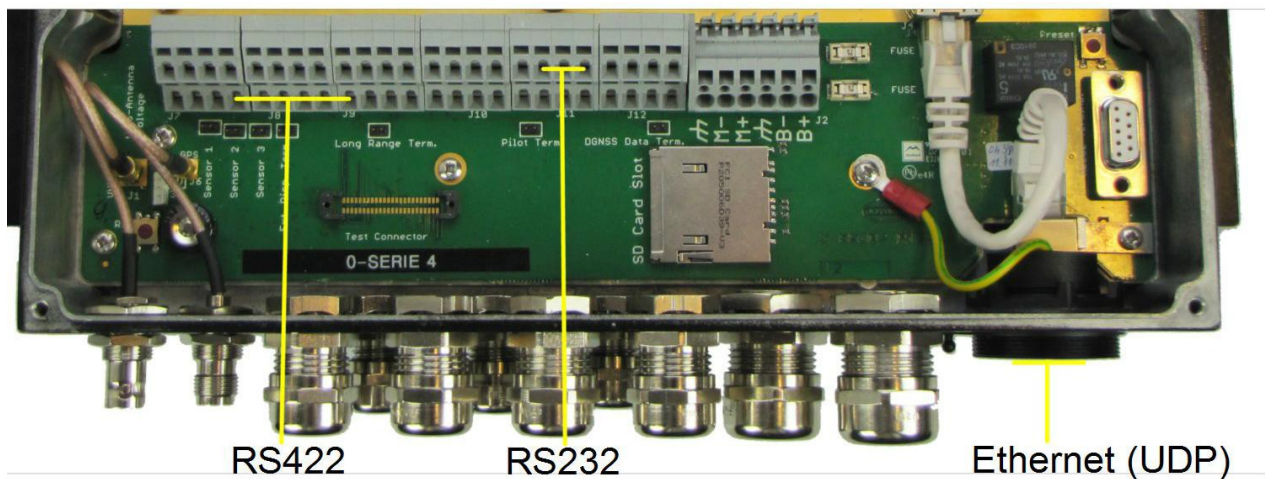


Figure 6.13 External display connections

Connections described here can also be done in the MX512 output ports. Please refer to the MX512 installation manual for wiring diagram.

Default speed on this port is 38400 baud.

#	In/Out	Type	Usage	Name
4	In	IEC61162-2 RS-422	MX510 MX512 Display	RD2-B(+)
5				RD2-GND (ISO GND)
6	In			RD2-A(-)
7	Out			TD2-A (-)
8				TD2-GND (ISO GND)
9	Out			D2-b (+)

42	Out	RS-232	External Display	TX (Transmit)
43	In			RX (Receive)
44	Out			232-GND (Ground)

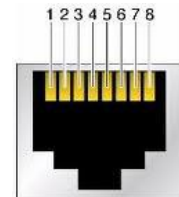


Figure 8.13 Ethernet RJ45 connector

	In/Out	Type	Usage	Name
1	Out/In	Ethernet (UDP) 100Base-T	NOT USED	TX+ / RX+
2	Out /In			TX- / RX-
3	In/Out			RX+ / TX+
4	-			-
5	-			-
6	In/Out			RX- / TX-
7	-			-
8	-			-

Please note! The “Ethernet” interface is auto detecting RX and TX similar as a network switch. You don’t need to think about crossed cable or not!

6.3.9 Pilot/Aux. Display Connection

This Port may be mandatory to be used with Pilot port connector (See picture below) on some vessels. Otherwise, this port may be used to connect the ECS/ECDIS).

This port is one of two options to connect a Pilot connector, as it is also possible to connect Pilot port cable to the MX512 Display Unit, see installation manual for the MX512.

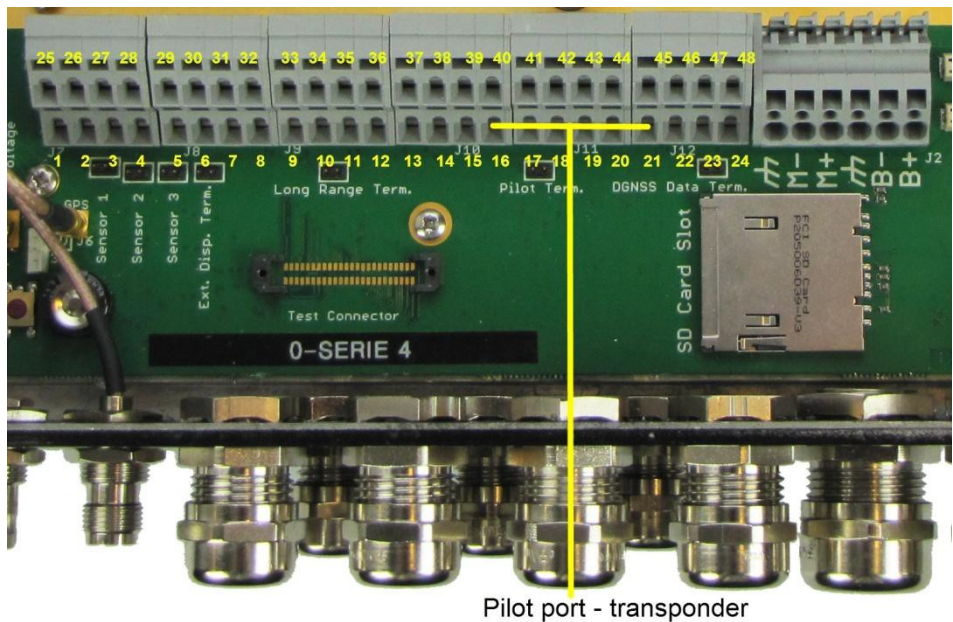


Figure 6.15 Pilot plug with cable 1



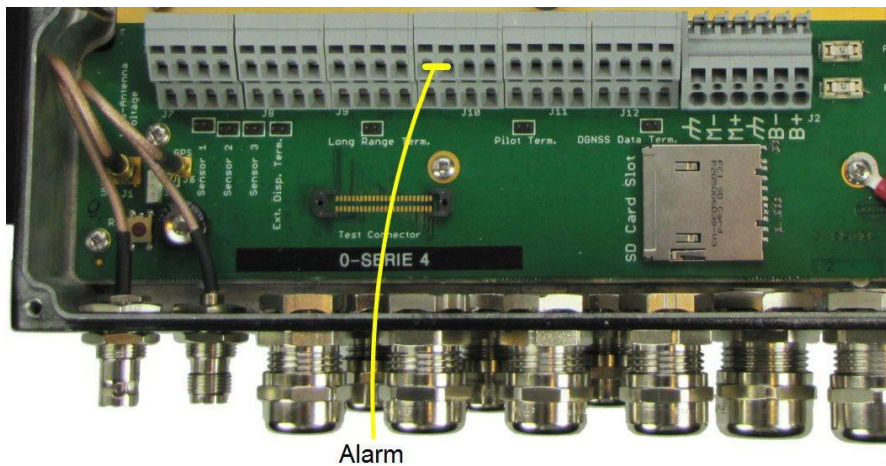
Figure 6.16 AMP 206486-1 (Pilot Plug) pin out

Default speed on this port is 38400 baud.

#	In/Out	Type	Usage	Name	Connects to AMP 206486-1 Pin no:
16	In	IEC61162-2 (RS422)	Pilot / Aux Display	RD4-B (+)	6
17				RD4-GND (Iso Gnd)	9
18	In			RD4-A (-)	5
19	Out			TD4-A (-)	1
20				TD4-GND (Iso Gnd)	
21	Out			TD4-B (+)	4

6.3.10 Alarm Connection

Below picture shows where to connect external Alarm to MX535B



#	In/Out	Type	Usage	Name
37	Out	Relay (NO)	Alarm	ALARM_A
38	Out			ALARM_B

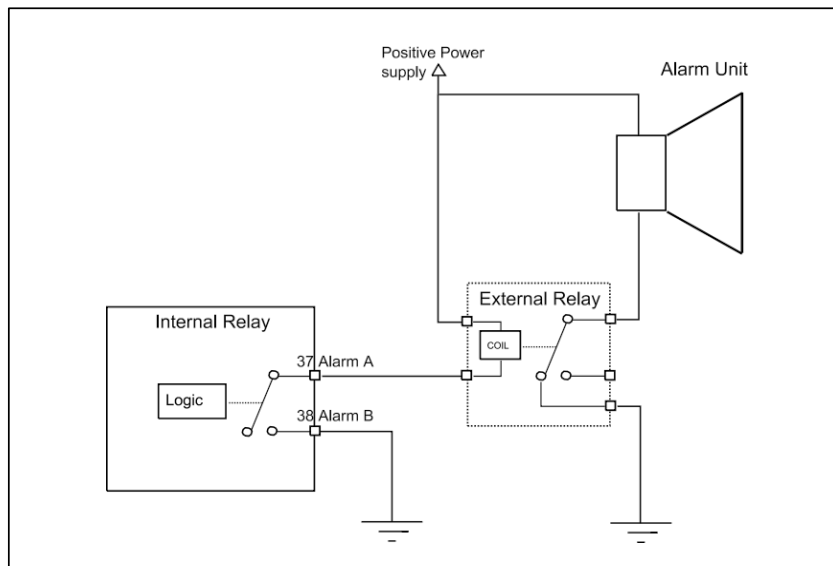


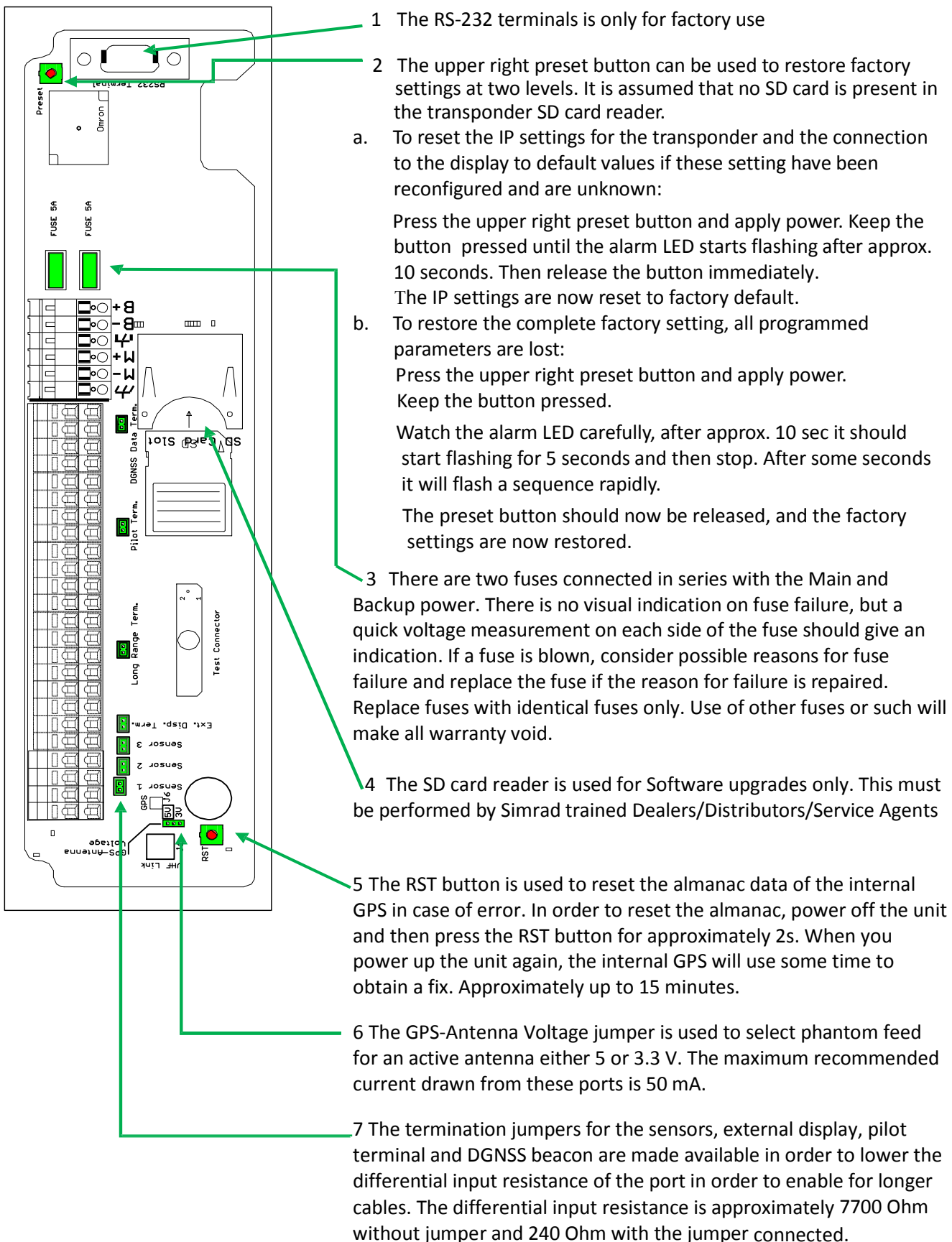
Figure 6.17 Typical Alarm connections

In this configuration, both the external relay and the alarm unit are powered from external power source, and the alarm unit is grounded through the external relay if an alarm occurs or the main power to the AIS is removed or if the MX535B would become defective.

Other configurations may be used, but remember that the Alarm must function both on AIS Alarm conditions and power failure to the AIS.

The Alarm relay is a normally open earth free relay contact, provided as an independent and simple method for triggering an external alarm. The alarm relay is active in case of power off and is capable of driving a 2 A current. The maximum voltage over the alarm relay must not exceed 48 V. The alarm relay is deactivated upon acknowledgment of an alarm, either internally on the display unit, or by an externally provided ACK sentence. If the Transponder power is lost, and the Alarm relay has power, the alarm will be triggered. In this case, the only way to deactivate the Alarm is to power the Transponder unit or disconnect the power source of the Alarm relay.

6.3.11 Detailed Description of Connections, fuses, factory reset etc...



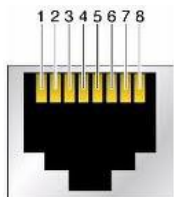


Figure 6.18 Ethernet RJ45 connector

Transponder (RJ45):

#	In/Out	Type	Usage	Name
1	Out/In	Ethernet (UDP) 100Base-T	NOT USED	TX+ / RX+
2	Out /In			TX- / RX-
3	In/Out			RX+ / TX+
4	-			-
5	-			-
6	In/Out			RX- / TX-
7	-			-
8	-			-

Note: The MX535B Transponder “Ethernet” interface is auto detecting RX and TX similar as a network switch. You don’t need to think about crossed cable or not.

7 Initial configuration

7.1 Short reference for initial configuration

Fill in **Own Ship** (CFG/AIS Static Menu)

- Ship Name
- IMO number
- MMSI –“-
- Call Sign
- GPS antenna positions
(Internal & external)
- Type of Vessel

Fill in **Voyage Settings** (CFG/AIS Voyage)

- Navigational status
- Destination
- ETA
- Draught
- Cargo Category

Check **reception of target ships in ship list** – normal operation (AIS 2 screen or PLOT 3).

7.2 Not all vessels carry AIS

It is important to remember that not all ships carry AIS, in particular leisure crafts, fishing boats, warships and some coastal shore stations including Vessel Traffic Service Centers.

7.3 Use of AIS in collision avoidance

As an anti-collision aid the AIS has some advantages over radar:

- Capable of instant presentation of target course alterations.
- Not subject to target swap.
- Not subject to target loss in clutter.
- Not subject to target loss due to fast maneuvers.
- Able to detect ships within VHF/FM coverage.

IMPORTANT

When using the AIS for anti-collision purposes it is important to remember that the AIS is an additional source of navigation information. It does not replace other navigational systems. The AIS may not always give the right picture of the traffic in your area separately.

7.4 Erroneous information

Erroneous information implies a risk to other ships as well as your own. Incorrectly configured or calibrated sensors might lead to transmission of incorrect information. It is the user's responsibility to ensure that all information entered into the system is correct and up to date.

8 Operation Instructions

8.1 Configuration Menu

The AIS configuration menu consists of three menus, namely:

- AIS Config
- AIS Static
- AIS Voyage

Each of these menus contains the settings and configurations most applicable to the user. Some of the AIS Static settings are write-protected by administrator password, but the user is always allowed to view the current settings.

8.1.1 AIS Configuration

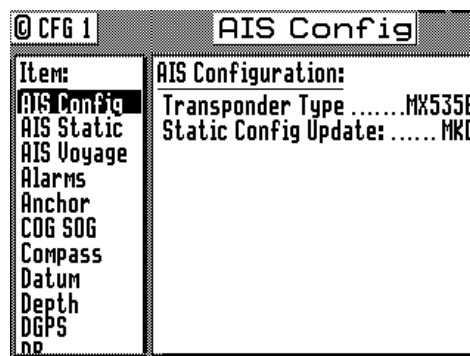
AIS Config Setup

The MX51x/AIS display was designed to work with several types of class “A” AIS transponder systems. The “Transponder type” setup allows the operator to customize the MX51x/AIS display to work with SAAB (R3), ATLAS, NAUTICAST or MX535B transponder models (other selections may become available in the future). The default setting for transponder type is MX535B.

The “Static Config Update:” setup is used to determine where the AIS configuration can be controlled from. Two possible selections are the MKD (MX510 or MX512 CDU) or ECDIS. The MKD is the default setting.

Follow the procedure below to select the “Transponder Type” and “Static Config Update” settings:

1. Press the **CFG** key.
2. Scroll to AIS Config menu.



3. Press the **EDIT** key (cursor will be on Transponder Type). Default selection is MX535B.
4. Press the **ENT** to activate the CHANGE softkey to toggle to a different transponder model (otherwise skip this step).
5. If you need to pass control to the ECDIS system, press the down arrow key to highlight the “Static Config Update” line.
6. Press the **ENT** key to change to ECDIS (MKD is the default setting).
7. Press the **EDIT** to exit.

8.1.2 AIS Static

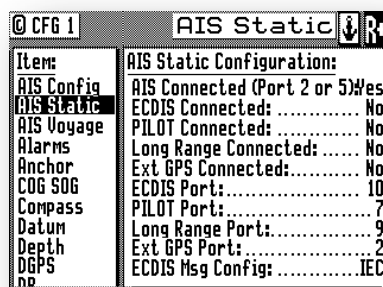
AIS Static Setup

The AIS Static Setup contains both the ship's static data and AIS transponder configuration. This setup must be done after installation or at any time changes are made to the ship's AIS transponder unit.

It is important to note that critical AIS static setup items (such as MMSI, IMO, Ship name, Call Sign and others) are password protected. Setup items that require administrator password are indicated in the *Display Field Descriptions* below. If an invalid or missing password is used, a password message will be displayed and the entry will be rejected. Press the 'Cancel alarm' softkey to continue.

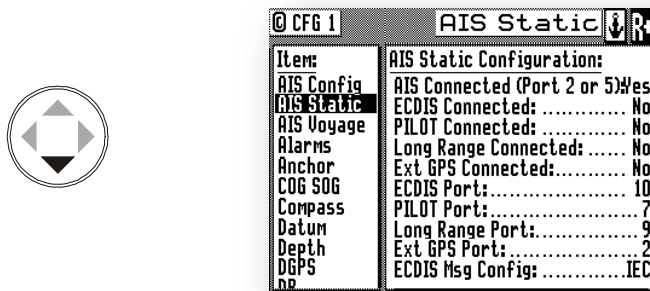
Follow the procedure below to enter the required AIS static information:

1. Press **CFG** key.
2. Highlight the **AIS Static** under the 'Item' column.



3. Press the **EDIT** key to start editing the AIS Static setup.
4. The "AIS Connected (Port 5): - No" will be highlighted, press the **ENT** key to activate the **Change** softkey to change the value to "Yes".
5. Move the highlight to other required setup items and enter the numeric values or press the **ENT** key to toggle the value. You will need to use the "admin" password to change critical values in the AIS Static menu (see page 63).
6. Press **EDIT** key when done editing the AIS Static menu.

More AIS Static configuration parameters are available by scrolling down using the down arrow cursor key as shown below.





CFG 1 AIS Stati	
Item:	AIS Static Configuration:
AIS Config	ECDIS Msg Config: IEC
AIS Static	PILOT Msg Config: IEC
AIS Voyage	Long Range Reply: MANUAL
Alarms	MMSI: 338124561
Anchor	Ship: JOTRON
COG SOG	Call Sign: TEST
Compass	IMO Number: 2386801
Datum	Chnl A & B - TX Mode:.. Transmit
Depth	MX Ant: Primary
DGPS	External GPS: Secondary
no	



CFG 1 AIS Stati	
Item:	AIS Static Configuration:
AIS Config	Passthru NMEA: No
AIS Static	MX Ant A: 0m
AIS Voyage	MX Ant B: 0m
Alarms	MX Ant C: 0m
Anchor	MX Ant D: 0m
COG SOG	Ext GPS Ant A: 0m
Compass	Ext GPS Ant B: 0m
Datum	Ext GPS Ant C: 0m
Depth	Ext GPS Ant D: 0m
DGPS	AIS GPS Ant A: 0m
no	



CFG 1 AIS Static	
Item:	AIS Static Configuration:
AIS Config	AIS GPS Ant A: 0m
AIS Static	AIS GPS Ant B: 0m
AIS Voyage	AIS GPS Ant C: 0m
Alarms	AIS GPS Ant D: 0m
Anchor	Data Timeout: 360s
COG SOG	Sensor 1 Baud Rate: 4800
Compass	Sensor 2 Baud Rate: 4800
Datum	Sensor 3 Baud Rate: 4800
Depth	
DGPS	
no	

Note: A total of 37 lines are available under the AIS Static menu. If only 10 lines are listed, the MX51x may not be communicating with the transponder. Verify that the “AIS Connected” value is set to YES and the correct transponder type is selected.

Display Field Descriptions:

AIS, ECDIS, PILOT, Long Range, Ext. GPS Connected: Use the **CHANGE** softkey by pressing **ENT** key to change the value to Yes.

ECDIS, PILOT, Long Range, Ext. GPS Port: Use the **CHANGE** softkey by pressing the **ENT** key to scroll through the port# to which the device is connected. “AIS Port” is pre-selected to NMEA 5, Long-Range Communication port is NMEA 6, ECDIS is on NMEA 7 and the Pilot port is on NMEA 9.

ECDIS and PILOT Msg Config: Use the **CHANGE** softkey by pressing the **ENT** key to change the communication protocol. EIC protocol is preferred by most AIS Transponder.

Long Range Reply: Use the **CHANGE** softkey by pressing the **ENT** key to change value to AUTO, Manual or Off. In Manual mode, the user is prompted to reply to the Long-Range system

when interrogated. In Auto mode, the MX51x/AIS will automatically send a reply when interrogated. In Ext. Appl (External Application) mode, the MX51x/AIS passes the request onto the high-speed ports (ECDIS & Pilot), and waits for their response to prepare answer back to long range system.

MMSI: A 9-digit Maritime Mobile Service Identification number used for identification of ship and message (administrator password required).

Note: When editing critical transponder setup items use the “admin” password.

Ship: Enter the vessel name up to 20-characters (administrator password required). The symbol ããããã (or blank) indicates name is not available.

Call Sign: Enter the 7-character vessel’s call sign (administrator password required). The symbol ãããã (or blank) indicates call sign is not available.

IMO Number: Enter the 9-digit IMO identification number when available (administrator password required).

Chnl A & B-TX Mode: Use the **CHANGE** softkey by pressing the **ENT** key to select between Transmit and Silent (administrator password required).

External GPS Ant: You can designate the external GPS to be a primary or secondary source of GPS position. Default value is SECONDARY.

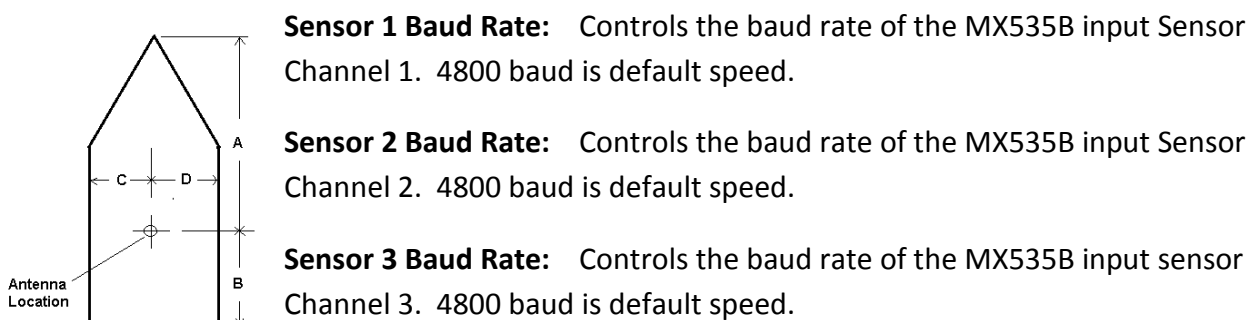
Passthru NMEA: Use the **CHANGE** softkey by pressing the **ENT** key to change the value to YES if you want the NMEA data from the antenna to be passed through to the data ports. Normally set to NO.

MX Ant (A, B, C & D): This sets the location of the PRIMARY source of GPS position antenna. Specify the position location (in meters) See the drawing below.

External GPS Ant (A, B, C, D): This sets the location of the Ext. GPS antenna (a.k.a. Secondary) in meters (similar to the primary GPS Ant A,B,C,D).

AIS GPS Ant A, B, C, D: Specify the position offset of the GPS globe antenna used in the MX535B AIS transponder (administrator password required).

Data Timeout: Allows you to change the time the AIS targets will stay on the MX51x screen to match that of the ECDIS or RADAR AIS targets. Pre-set value is 360 seconds.



NOTE: Changing the baud rate requires re-cycling the power to the MX535B for the change to take effect.

How to change transponder settings under the AIS Static configuration using the administrator password:

1. Press the **CFG** key.
2. Scroll down to AIS Static menu.
3. Press the **EDIT** key to bring up the cursor.
4. Scroll down to MMSI, Ship or Call Sign field.
5. Highlight the SET AIS PASSWORD softkey using the left (or right) arrow key.
6. Press the **ENT** key to commence entry of the “admin” password using the procedure below:

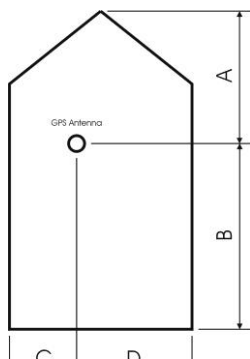
*To enter the password “**admin**” do the following:*

- a. Press the #1 key to bring up the lowercase letter “a”.
 - b. The cursor will advance to the next character.
 - c. Press #2 key 1 time to bring-up the letter “d”.
 - d. Press the #5 key one time for letter “m”.
 - e. Press the #3 key 3 times for letter “i”.
 - f. Press the #5 key 2 times for letter “n”.
 - g. Highlight the DONE softkey and then press the **ENT** key.
7. Move the cursor to the MMSI number and enter the desired value using the numeric keypad.
 8. Move the highlight to “Ship:” and spell out the name of the vessel (up to 20 alphanumeric characters).
 9. Move the highlight to “Call Sign:” and enter up to 7 characters.
 10. To change other setup items, scroll down or up to it and enter the number or name required.
 11. At the end of editing, press the **EDIT** key to exit.

8.1.3 Ship Dimension and Antenna Position

How to enter the antenna position:

The setting of the Ship Dimensions and the Antenna positions are combined as follows:



A: Distance from bow to GPS antenna position in meters.

B: Distance from stern to GPS antenna position in meters.

C: Distance from port to GPS antenna position in meters.

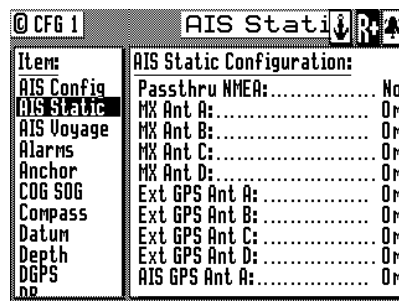
D: Distance from starboard to GPS antenna position in meters.

Figure 8.1 Ship Dimension and GPS antenna position

The position of the internal (backup) and the external GPS antenna (Primary or Secondary) need to be entered manually.

To configure “GPS Antenna position”, follow the procedure below:

1. Press the **CFG** key.
2. Scroll down to AIS Static menu.
3. Press the **EDIT** key to bring up the cursor.
4. Move the cursor down to MX Ant A, B, C, D field to set the location of the PRIMARY antenna.



5. Highlight the SET AIS PASSWORD softkey using the left (or right) arrow key.
6. Press the **ENT** key to commence entry of the “admin” password using the procedure below:

To enter the password “admin” do the following:

- a. Press the #1 key to bring up the lowercase letter “a”.
 - b. The cursor will advance to the next character.
 - c. Press #2 key 1 time to bring-up the letter “d”.
 - d. Press the #5 key one time for letter “m”.
 - e. Press the #3 key 3 times for letter “i”.
 - f. Press the #5 key 2 times for letter “n”.
 - g. Highlight the DONE softkey and then press the **ENT** key.
7. Enter the numeric values (in meters) as per Figure 1.
 8. Move the cursor to the Ext GPS Ant (A, B, C & D) to set the SECONDARY antenna location. Enter the desired value using the numeric keypad.

9. Move the highlight to AIS GPS Ant (A, B, C & D) to set the BACKUP or internal GPS antenna location.
10. At the end of editing, press the **EDIT** key to exit.

8.2 Regional settings

The regional settings are primarily used by local base stations to assign special frequencies or transmitter configurations for certain areas. It is also allowable to add or edit the regions, **but this should be done with caution, as incorrect frequency settings for an area will disable the functionality of the AIS system.** Altering the regional settings is protected by a user password. The Area named HIGH SEA, is the default area and contains the whole world, except from the other regions, if defined.

Each Region is defined by the following parameters:

Area, defined as North East corner and South West corner.

Two channels used for VHF communications.

Rx/Tx mode is used to restrict the transmission to one of the two channels.

Transitional zone defines the area surrounding an area in order to switch the frequencies in a step by step order.

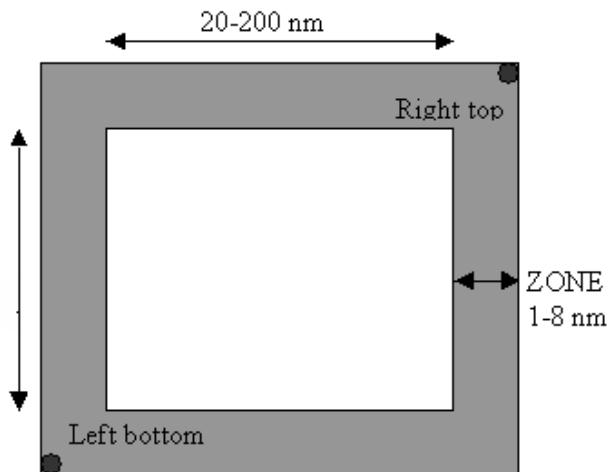
The screenshot shows a screen titled "REGIONAL AREA" with a status bar at the top left indicating "© AIS 6". The screen is divided into several sections for configuration:

- REGION:** A dropdown menu.
- IN USE:** A dropdown menu.
- TIME:** A dropdown menu.
- CHANNEL:** A dropdown menu.
- BAND:** A dropdown menu.
- Tx/Rx:** A dropdown menu.
- CHNL A:** A text input field.
- CHNL B:** A text input field.
- POWER:** A text input field.
- NE LAT:** A text input field.
- SW LAT:** A text input field.
- NE LON:** A text input field.
- SW LON:** A text input field.
- ZONE SIZE:** A text input field.
- NM:** A text input field.

The user is allowed to Add Regions manually, but caution is advised. It is not allowed to delete regions; they will be deleted on timeout after 24 hours inactivity, if the ship is more than 500 NM away from the region, or if the region is overwritten. There is a maximum amount of 8 regions in addition to the HIGH SEA region.

8.2.1 Transition Zone

A Region must be between 20 and 200 Nautical miles and within this region there will be a “Transition zone” between 1 and 8 Nautical miles:



This zone is used for frequency transition so only one frequency is changed at a time. There are defined rules for how the AIS will behave through this zone.

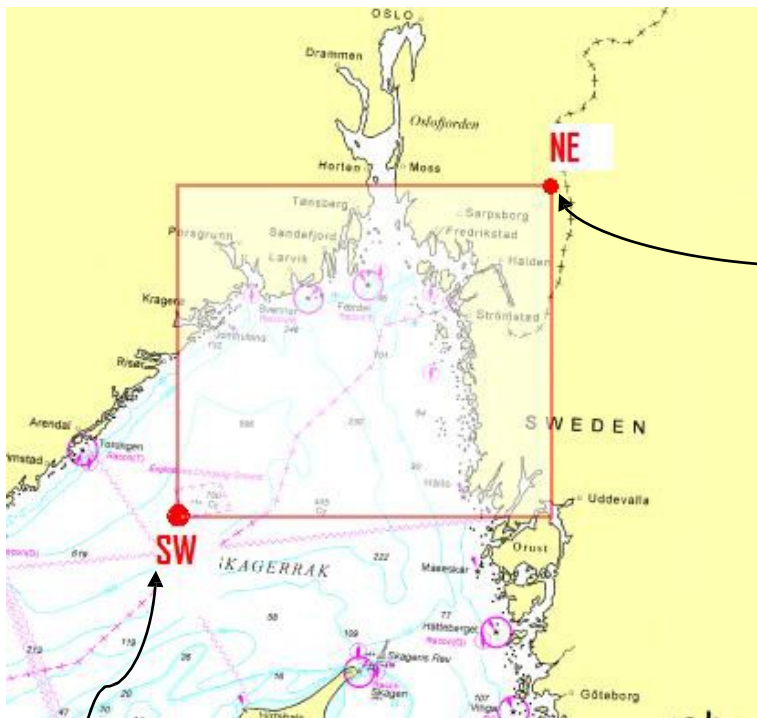
The AIS will continuously monitor for its own position and range to the regional areas defined. By entering transition Zone of Region 1, frequency is changed on the primary channel. The AIS is now sending the primary frequency defined for each of the regions.

When the boundary for the Region 1 is crossed, the second frequency shall be changed. Then the primary frequency for the old region (or default setting) is switched with the secondary frequency for the new region. Then both frequencies have changed.

When entering another region, frequency transition is performed as described above with the frequencies (settings) of the new region. When leaving a region, frequency transition is reset to perform the default values.

8.2.2 Define Region

A Region must be between 20 and 200 Nautical miles as described above and you must define the Longitudes and Latitudes of the South West and North East corners:



The values are defined by selecting these 4 buttons:

settings	
NE Longitude: 0°00.0E	NE Latitude: 0°00.0N
SW Longitude: 0°00.0E	SW Latitude: 0°00.0N

South West corner

North East corner

If the values are within 20 – 200 NM, they will be accepted, and you will be asked if you want to save it:

8.2.3 AIS Alarms

The AIS Alarm is triggered if a failure is detected in one or more of the AIS functions or data. The corresponding message is given in table below. The most probable source of error and corresponding system behavior is described together with some notes on troubleshooting the error.

Alarm ID	Description	Cause / Source of error	Reaction of the system and user advise
001	Tx malfunction	VHF Antenna or cabling mismatch. Alternatively Invalid MMSI	The Transponder stops transmission. Check the antenna cabling for short or open circuits. Alternatively check the VHF antenna. Check that the MMSI number is correct.
002	Antenna VSWR (Voltage Standing Wave Ratio) exceeds limit	VHF antenna or installation	The Transponder continues transmission. Check the VHF antenna and the cabling. Make sure the cables are 50 Ohm.
003	Rx channel 1 malfunction	Internal frequency error*	The Transponder stops transmission on the affected channel. Try rebooting the system. Alternatively, service is needed.
004	Rx channel 2 malfunction	Internal frequency error*	The Transponder stops transmission on the affected channel. Try rebooting the system. Alternatively, service is needed.
005	Rx channel 70 malfunction	Internal frequency error*	The Transponder continues normal transmission but is not able to receive DSC messages. Try rebooting the system. Alternatively, service is needed.
006	General failure	Missing MMSI, internal error	The Transponder stops transmission. Check MMSI and the other parameters.
007	UTC sync invalid	GPS antenna or installation	The Transponder continues operation using indirect or semaphore synchronization with other AIS units. If the received GPS signal strength is low, the GPS might use some time to get the first fix. Consider waiting 15 minutes. Check the GPS antenna and cabling. If the antenna is an active type, check that the phantom DC voltage is correct.
008	MKD connection lost	Connection between the Display Unit and the Transponder is corrupted	The Transponder continues operation, and alerts other AIS systems that no display is present. Check that the display is turned on. Check cable connection in both ends.

009	Internal / external GNSS position mismatch	Internal or External GPS or Antennas	The Transponder continues operation, but as this might imply that wrong position is used. Care should be taken as this might impose a risk both for own and other ships. Check the positioning of the GPS antennas. Disconnect the External GPS and check if the internal GPS provides the correct position.
010	Navigational Status incorrect	Setup or speed sensor (Navigational status does not correspond with the given speed)	The Transponder continues operation. Check that navigational status is not at anchor, moored or aground while SOG >3 knots. Check that navigational status is not under way while SOG = 0 knots. Check that SOG is correct.
011	Heading sensor offset	COG sensor / HDT sensor Alarm ID 11 is activated when SOG is greater than 5 knots and the difference between COG and HDT is greater than 45 degrees for 5 min.	The Transponder continues operation. Alarm indicates mismatch between Course Over ground and True heading. Check sensors. If current speed is < 5knots, check SOG.
014	Active AIS SART	AIS Search and rescue beacon activated	The Transponder continues operation. Contact local RCC (Rescue Coordination Centre). Be prepared to assist in search and rescue operation. Listen on VHF channel 16 for additional information.
025	External EPFS lost (External Satellite Positioning System)	No valid position data on sensor ports	The Transponder continues operation with the internal GPS receiver. If no valid position is present on the internal sensor, ALR26 is also displayed. Check antenna and connections for EPFS, check sensor. Check baud rate settings.
026	No sensor position in use	Internal and external GPS sensor	The Transponder continues operation. Check cabling and antenna for the internal GPS sensor. At start up the GPS might need some time to receive almanac data. Up to 15 minutes might be required.
029	No valid SOG information	Internal and external speed sensor	The Transponder continues operation using default data. Check wiring and external sensor. Check baud rate settings.
030	No valid COG information	Internal and external course sensor	The Transponder continues operation using default data. Check wiring and external sensor. Check baud rate settings.
032	Heading lost/invalid	External heading sensor	The Transponder continues operation using default data. Check wiring and external sensor. Check baud rate settings.

035	No valid ROT information	External rotation sensor	The Transponder continues operation using default data. Check wiring and external sensor. Check baud rate settings.
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Table 2: Integrity alarm conditions signaled using ALR sentence formatter.

***The Rx Alarm is triggered if one of the internal frequency generators is out of lock, making the receiver unable to function at the correct frequency.**

Any of the AIS Alarms can be deselected using the procedure below:

1. Press the **CFG** key.
2. Scroll to ALARMS menu.
3. Press the **EDIT** key.
4. Scroll down to the bottom of the alarm list where all the AIS alarms are located.
5. Press the **ENT** key to change the value to OFF (to deactivate) or ON (to activate).
6. Press the **EDIT** key to exit.

8.2.4 Alarm Relay Output

The Alarm relay is a normally open earth free relay contact, provided as an independent and simple method for triggering an external alarm. The alarm relay is deactivated upon acknowledgment of an alarm, either internally on the display unit, or by an externally provided ACK sentence. If the Transponder power is lost, and the Alarm relay has power, the alarm will be triggered. In this case, the only way to deactivate the Alarm is to power the Transponder unit or disconnect the power source of the Alarm relay.

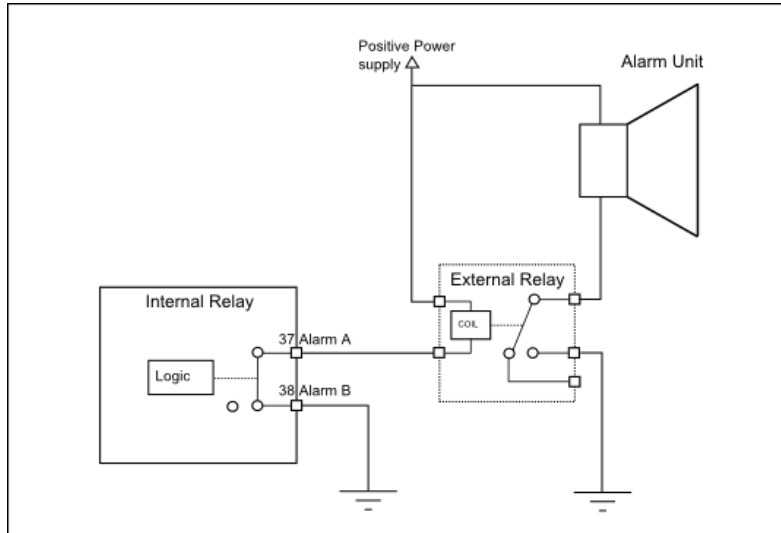


Figure 8.2 Typical Alarm connection

8.2.5 AIS Status indicators

AIS Status indicators (AIS9 screen)

The table below shows the status indicators and description shown in the AIS9 screen.

Text Identifier	“Indicators” (Shown on Display unit and also sent as text message to ECS/ECDIS or other equipment connected to PI port)	Description
021	External DGNSS in use	DGNSS is normally the same as DGPS, which indicates external type of such sensor is in use
022	External GNSS in use	GNSS is normally the same as GPS, which indicates external type of such sensor is in use
023	Internal DGNSS in use (beacon)	Internal DGNSS (DGPS) (beacon) in use indicates a D GNSS beacon receiver is connected and transmit valid data to TR-8000
024	Internal DGNSS in use (Message 17)	Internal DGNSS (DGPS) (Message 17) in use indicates Differential correction data is sent from an AIS Base Station to this TR-8000 transponder
025	Internal GNSS in use	The in built GNSS (GPS) receiver is in use
027	External SOG/ COG in use	SOG (Speed Over Ground)/COG (Course Over Ground) from external. GNSS (GPS) device is in use
028	Internal SOG/ COG in use	SOG (Speed Over Ground)/ COG (Course Over Ground) from internal. GNSS (GPS) device is in use
031	Heading valid	True Heading is received from either an external Gyro or Satellite compass
033	(ROT) Rate of Turn Indicator in use	ROT received from external sensor: TI (Turn Indicator)
034	Other ROT source in use	No TI (Turn Indicator) from external sensor, ROT (Rate of Turn) value is calculated from HDT internally
036	Channel management parameters changed	If either “Region setting” is applied manually or from msg. received

8.2.6 Sensor Baud rate

MX535B Sensor Port Baud rate:

The baud rate of sensor ports 1, 2 and 3 can be controlled using the MX51x display. Use the procedure below to change the baud rate:

1. Press the **CFG** key.
2. Scroll down to AIS Static menu.
3. Press the **EDIT** key.
4. Enter the password using the “Set AIS Password” softkey. This softkey will be highlighted.
5. Press the **ENT** key to commence entry of the “admin” password using the procedure below:

To enter the password “admin” do the following:

- a. Press the #1 key to bring up the lowercase letter “a”.
 - b. The cursor will advance to the next character.
 - c. Press #2 key 1 time to bring-up the letter “d”.
 - d. Press the #5 key one time for letter “m”.
 - e. Press the #3 key 3 times for letter “i”.
 - f. Press the #5 key 2 times for letter “n”.
 - g. Highlight the Done softkey, then press the **ENT** key.
 - h. Press the #5 key 2 times for letter “n”.
 - i. Highlight the Done softkey, then press the **ENT** key.
6. Scroll down to “Sensor 1 Baud Rate: 4800” (or other sensor #) to 38,400.
 7. Highlight the CHANGE softkey.
 8. Press the **ENT** key to change the baud rate.
 9. Press the **EDIT** key to exit.
 10. You will need to recycle the power to the MX535B so this baud rate change will take effect.

CFG 1 AIS Static	
Item:	AIS Static Configuration:
AIS Config	AIS GPS Ant A:..... 0m
AIS Static	AIS GPS Ant B:..... 0m
AIS Voyage	AIS GPS Ant C:..... 0m
Alarms	AIS GPS Ant D:..... 0m
Anchor	Data Timeout:..... 360s
COG SOG	Sensor 1 Baud Rate:.....4800
Compass	Sensor 2 Baud Rate:.....4800
Datum	Sensor 3 Baud Rate:.....4800
Depth	
DGPS	
DP	

8.2.7 Silent Mode

Silent Mode

The silent mode is a special mode for travelling in areas where the transmission of own position impose risk to the user. When active, no signals are sent from the Transponder unit, but the user is still able to receive information from other vessels.

CAUTION: The *Silent Mode* disables the AIS Transmitter functionality and will make the Vessel invisible on the AIS system and impose a risk to own and other vessels.

To activate the SILENT mode, use the procedure below:

1. Press **CFG** key.
2. Highlight the **AIS Static** under the "Item:" column.
3. Press the **EDIT** key to start editing the AIS Static setup.
4. Enter the password using the "Set AIS Password" softkey. This softkey will be highlighted.
5. Press the **ENT** key to commence entry of the "**admin**" password using the procedure below:
 - a. To enter the password "admin" do the following:
 - b. Press the #1 key to bring up the lowercase letter "a".
 - c. The cursor will advance to the next character.
 - d. Press #2 key 1 time to bring-up the letter "d".
 - e. Press the #5 key one time for letter "m".
 - f. Press the #3 key 3 times for letter "i".
 - g. Press the #5 key 2 times for letter "n".
 - h. Highlight the Done softkey, then press the **ENT** key.
6. Scroll down to "**CHANL A&B – TX Mode.... Transmit**".
7. Move the highlight to CHANGE softkey.
8. Press the **ENT** key to change the value to "SILENT".
9. Press **EDIT** key to exit.
10. Don't forget to turn the Chnl A&B – TX Mode back to transmit after transiting the area.

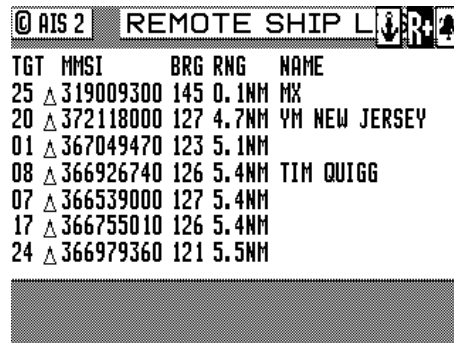


CFG 1 AIS Stati	
Item:	AIS Static Configuration:
AIS Config	ECDIS Msg Config: IEC
AIS Static	PILOT Msg Config: IEC
AIS Voyage	Long Range Reply:.....MANUAL
Alarms	MMSI:.....338124561
Anchor	Ship: JOTRON
COG SOG	Call Sign:..... TEST
Compass	IMO Number:..... 2386801
Datum	Chnl A & B - TX Mode:.. Transmit
Depth	MX Ant:..... Primary
DGPS	External GPS:..... Secondary
no	

8.2.8 Test VHF transmission

The communications test is used to verify the operation of the VHF communication by transmitting a request for an acknowledgement to another ship (a.k.a. “ping”). The user can select an AIS target from the list in AIS 2 screen as long as the target is a Class A AIS transponder and “ping” it. This can be done under the AIS 4 screen. You can send a TEST text message to any class A AIS target and hopefully it will send an acknowledgement message back. If the Acknowledgment is not received within 10 seconds, an alarm message will be sounded. It is possible that the Communications Test has failed or the auto ACK feature of the AIS target has not been activated. The user should retry with another target.

If the MX535B is in “Silent mode”, it is not possible to perform this test:

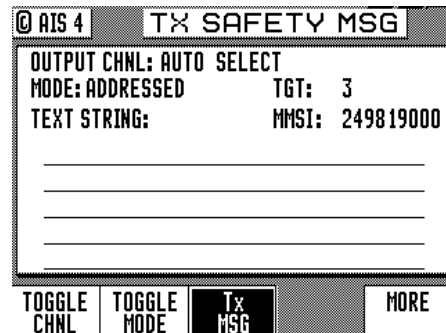


TGT	MMSI	BRG	RNG	NAME
25	△ 319009300	145	0.1NM	MX
20	△ 372118000	127	4.7NM	YM NEW JERSEY
01	△ 367049470	123	5.1NM	
08	△ 366926740	126	5.4NM	TIM QUIGG
07	△ 366539000	127	5.4NM	
17	△ 366755010	126	5.4NM	
24	△ 366979360	121	5.5NM	

Using the AIS 2 screen, you can pick a target number using the TGT index number and use that to “ping”.

To “ping” a target, do the following:

1. Press the **AIS** key several times until the AIS 4 screen appears.
2. Press the **EDIT** key to bring up the cursor to “TGT:” field.
3. Enter the index (or TGT# i.e. #3) number of the target vessel as listed in the AIS 2 screen.
4. The MMSI field will be populated with the MMSI# for the selected vessel.



© AIS 4		TX SAFETY MSG	
OUTPUT CHNL: AUTO SELECT			
MODE: ADDRESSED		TGT: 3	
TEXT STRING:		MMSI: 249819000	
TOGGLE CHNL	TOGGLE MODE	Tx MSG	MORE

5. Scroll down to the text string field and type the word “TEST” using the alphanumeric keypad.
6. Highlight the “Tx MSG” softkeys using the left (or right) arrow key.
7. Press the **ENT** key to transmit.
8. Press the **EDIT** key to exit.
9. Press the right arrow key to bring up AIS 5 screen. If the pinged target sends an acknowledgement, the word YES will be indicated under the ACK field. If no acknowledgement is received within 10 seconds, the word NO will be indicated and an alarm message will be shown on the display.

8.2.9 Security Log

If the transmitter functionality of the transponder stops functioning for more than 15 minutes, this is logged as an event in the AIS 11 (SECURITY LOG) screen.

@ AIS 11		SECURITY LOG		↓	↑
	Start Time	End Time	Cause		
1)	11/26/20 07:58	11/28/20 17:03	POW.		
2)	11/24/20 14:10	11/24/20 15:12	POW.		
3)	11/22/20 20:17	11/22/20 21:51	POW.		
4)	11/22/20 16:21	11/22/20 17:48	POW.		
5)	11/09/20 16:23	11/09/20 17:02	POW.		

9 List of VHF Channels

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
6	156.3000	1021	157.0500	1279	156.9775	2219	161.5625
8	156.4000	1022	157.1000	1280	157.0375	2220	161.6125
9	156.4500	1023	157.1500	1281	157.0875	2221	161.6625
10	156.5000	1024	157.2000	1282	157.1375	2222	161.7125
11	156.5500	1025	157.2500	1283	157.1875	2223	161.7625
12	156.6000	1026	157.3000	1284	157.2375	2224	161.8125
13	156.6500	1027	157.3500	1285	157.2875	2225	161.8625
14	156.7000	1028	157.4000	1286	157.3375	2226	161.9125
15	156.7500	1060	156.0250	1287	158.3875	2227	161.9625
16	156.8000	1061	156.0750	2001	160.6500	2228	162.0125
17	156.8500	1062	156.1250	2002	160.7000	2260	160.6375
67	156.3750	1063	156.1750	2003	160.7500	2261	160.6875
68	156.4250	1064	156.2250	2004	160.8000	2262	160.7375
69	156.4750	1065	156.2750	2005	160.8500	2263	160.7875
70	156.5250	1066	156.3250	2007	160.9500	2264	160.8375
71	156.5750	1078	156.9250	2018	161.5000	2265	160.8875
72	156.6250	1079	156.9750	2019	161.5500	2266	160.9375
73	156.6750	1080	157.0250	2020	161.6000	2278	161.5375
74	156.7250	1081	157.0750	2021	161.6500	2279	161.5775
75	156.7750	1082	157.1250	2022	161.7000	2280	161.6375
76	156.8250	1083	157.1750	2023	161.7500	2281	161.6875
77	156.8750	1084	157.2250	2024	161.8000	2282	161.7375
208	156.4125	1085	157.2750	2025	161.8500	2283	161.7875
209	156.4625	1086	157.3250	2026	161.9000	2284	161.8375
210	156.5125	1087	157.3750	2027	161.9500	2285	161.8875
211	156.5625	1088	157.4250	2028	162.0000	2286	161.9375
212	156.6125	1201	156.0625	2060	160.6250	2287	161.9875
213	156.6625	1202	156.1125	2061	160.6750		
214	156.7125	1203	156.1625	2062	160.7250		
215	156.7625	1204	156.2125	2063	160.7750		
216	156.8125	1205	156.2625	2064	160.8250		
217	156.8625	1206	156.3125	2065	160.8750		
267	156.3875	1207	156.3625	2066	160.9250		
268	156.4375	1218	156.9125	2078	161.5250		
269	156.4875	1219	156.9625	2079	161.5750		
270	156.5375	1220	157.0125	2080	161.6250		
271	156.5875	1221	157.0625	2081	161.6750		
272	156.6375	1222	157.1125	2082	161.7250		
273	156.6875	1223	157.1625	2083	161.7750		
274	156.7375	1224	157.2125	2084	161.8250		
275	156.7875	1225	157.2625	2085	161.8750		
276	156.8375	1226	157.3125	2086	161.9250		
277	156.8875	1227	157.3625	2087	161.9750		
1001	156.0500	1228	157.4125	2088	162.0250		
1002	156.1000	1260	156.0375	2201	160.6625		
1003	156.1500	1261	156.0875	2202	160.7125		
1004	156.2000	1262	156.1375	2203	160.7625		
1005	156.2500	1263	156.1875	2204	160.8125		
1007	156.3500	1264	156.2375	2205	160.8625		
1018	156.9000	1265	156.2875	2206	160.9125		
1019	156.9500	1266	156.3375	2207	160.9625		
1020	157.0000	1278	156.9375	2218	161.5125		

Channel 2087 = Channel 87B Channel 2088 = Channel 88B

10 Complied Standards

The MX535B AIS system complies with the following standards:

IMO Resolution MSC.694 (17) – *General Requirements for Ship borne Radio Equipment forming part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids*

IMO Resolution MSC.74 (69) *Annex 3 Recommendation on performance standards for AIS*

IMO Resolution MSC.191 (79) – *Performance standards for the presentation of navigation related information on ship borne navigational displays*

ITU-R M.1371-4 (Class A), 2010 – *Technical characteristics for an automatic identification system using time-division multiple access in the VHF maritime mobile band*

ITU-R M.825-3, 1998 - *Characteristics of a transponder system using digital selective calling techniques for use with vessel traffic services and ship-to-ship identification*

ITU-R M.1084-4 – *Interim solutions for improved efficiency in the use of the band 156-174 MHz by stations in the maritime band*

IEC 61993-2, 2001 - *Maritime navigation and radio communication equipment and systems – Automatic Identification Systems (AIS), Part 2: Class A ship borne equipment of the universal automatic identification system (AIS) – Operational and performance requirements, methods of test and required results*

IEC 61108-1 Ed.2, 2003 – *Maritime navigation and radio communication equipment and systems – Global navigation satellite systems (GNSS)*

IEC 62288 Ed.1, 2008 – *Maritime navigation and radio communication equipment and systems – Presentation of navigation-related information on ship borne navigational displays – General requirements, methods of testing and required test results*

IEC 61162-1 Ed.4, 2010 - *Maritime navigation and radio communication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners*

IEC 61162-2 Ed.1, 1998 - *Maritime navigation and radio communication equipment and systems – Digital interfaces – Part 2: Single talker and multiple listeners, high-speed transmission*

IEC 60945 Ed.4, 2002 incl. Corr.1, 2008 – *Maritime navigation and radio communication equipment and systems – General requirements – Method of testing and required test results*

11 MX535B Technical Specifications

Conforming standards	
IMO Resolution A.694 (17) IMO Resolution MSC. 74(69) Annex 3 IMO Resolution MSC. 112(73) IMO Resolution MSC. 191(79) ITU-R W.1371-3 (CLASS A), 2007 ITU-R W.825-3, 1998 ITU-R W 1084-3, 1998	IEC 61993-2 ED. 1.0, 2001 IEC 61108-1 ED. 2.0, 2003 IEC 61162-1 ED. 3.0, 2007 IEC 61162-2 ED. 1.0, 1998 IEC 60945 ED. 4.0, 2002 Inc. Corr1, 2008 IEC 62286 ED. 1.0, 2008
Weight	
- MX51x Display unit	1.5 kg
- MX535B Transponder unit	3.7 kg
Dimensions:	
- MX51x Display unit – WxDxH	292 mm x 105.6 mm x 150 mm
- MX535 Transponder unit – WxDxH	319 mm x 204 mm x 77 mm
Supply, voltage	10.8-31.2 VDC
Power consumption:	
- MX51x Display unit:	15 W
- MX535B Transponder unit:	Receive: <15 W Transmit (max): <50 W
GPS module	16 Channels, L1 C/A code
AIS Channels, default	2087 (161.975 MHz) 2088 (162.025 MHz)
VHF Channels to be used by National Authorities all in the range of:	156 - 162.025 MHz
DSC Channel	70 (156.525 MHz)
RF output power	12.5 / 1 Watt
MX535B Interfaces	5X - IEC 61162-1 (RS422-adjustable baud rate) 2X - IEC 61162-2 (RS422-38400 b) 1X - RS232-adjustable baud rate: 1 I/O 1X - LAN (10Base-T Ethernet)
Data presentation	MX510 or MX512 Display unit Optional: ECDIS, ECS, ARPA or PC
Operational temperature range	-25°C to 55°C
Storage temperature range	-30°C to 70°C
STANDARD SUPPLY MX535B Transponder unit MX51x Display unit GPS antenna Product manual	OPTIONAL SUPPLY VHF antenna Combined VHF / GPS antenna Antenna signal splitter Gyro converter AC / DC converter Antenna cables

12 Mechanical Drawings

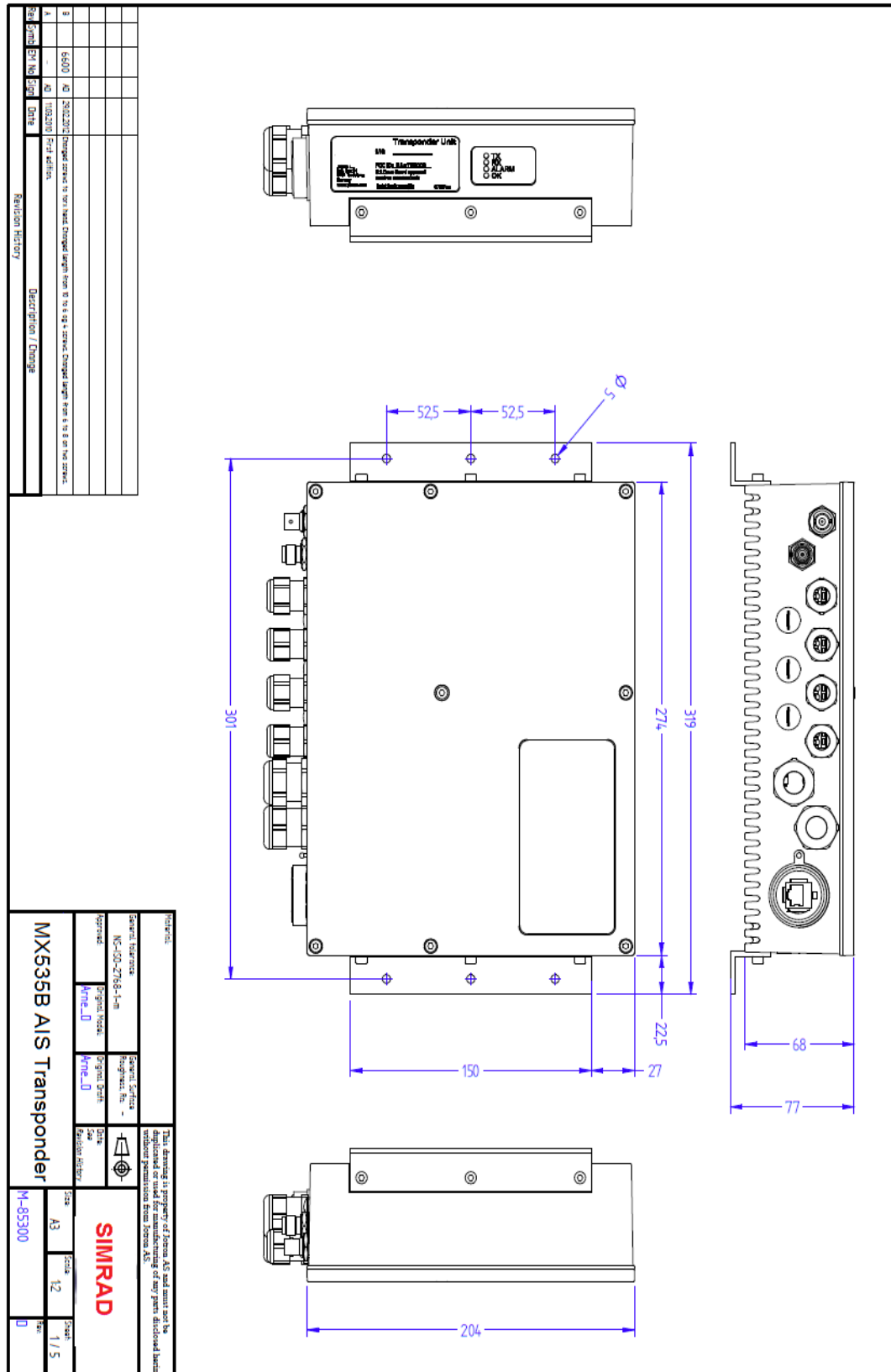


Figure 12.1 MX535 Mechanical Drawing

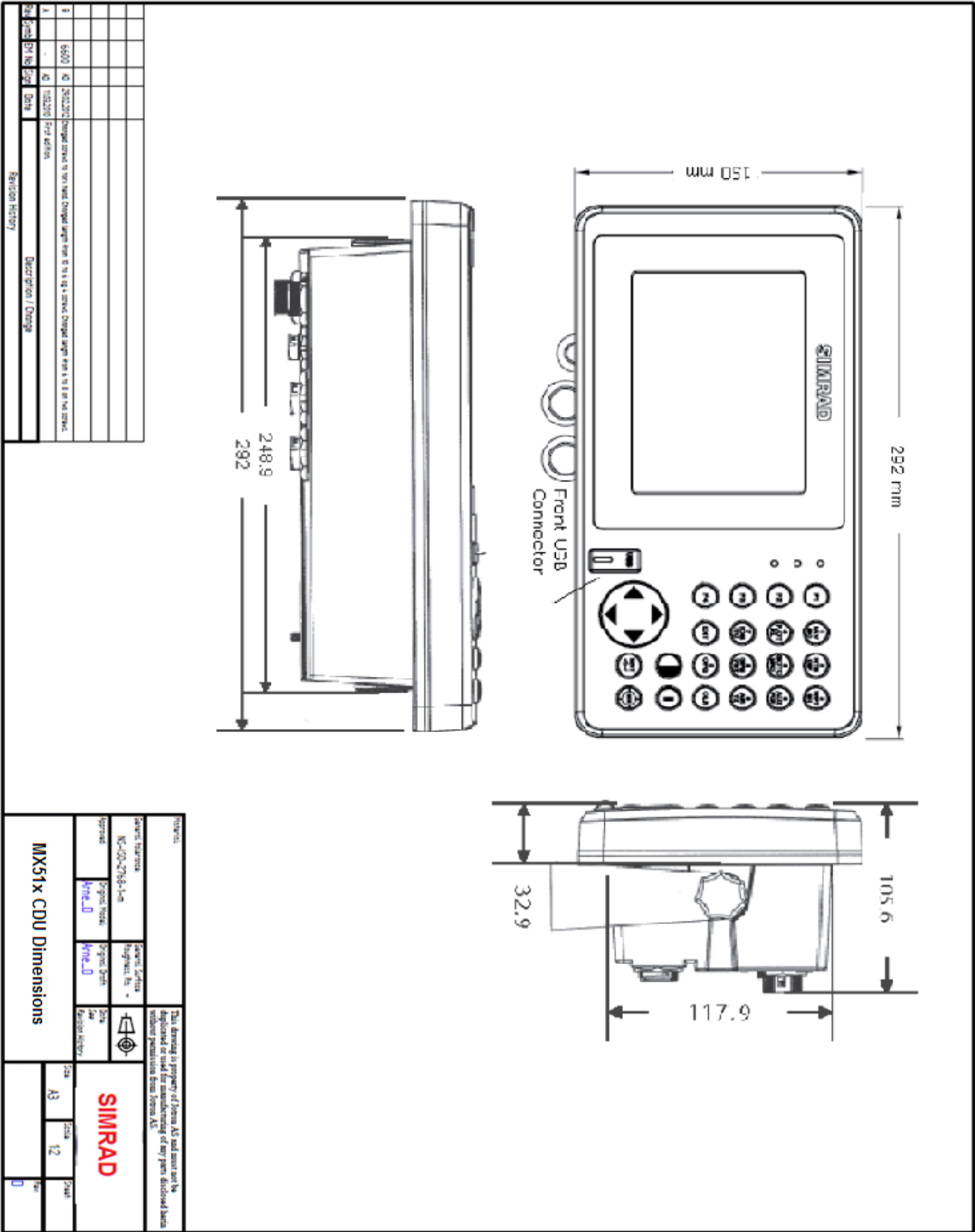


Figure 12.2 MX510/MX512 Mechanical Drawing

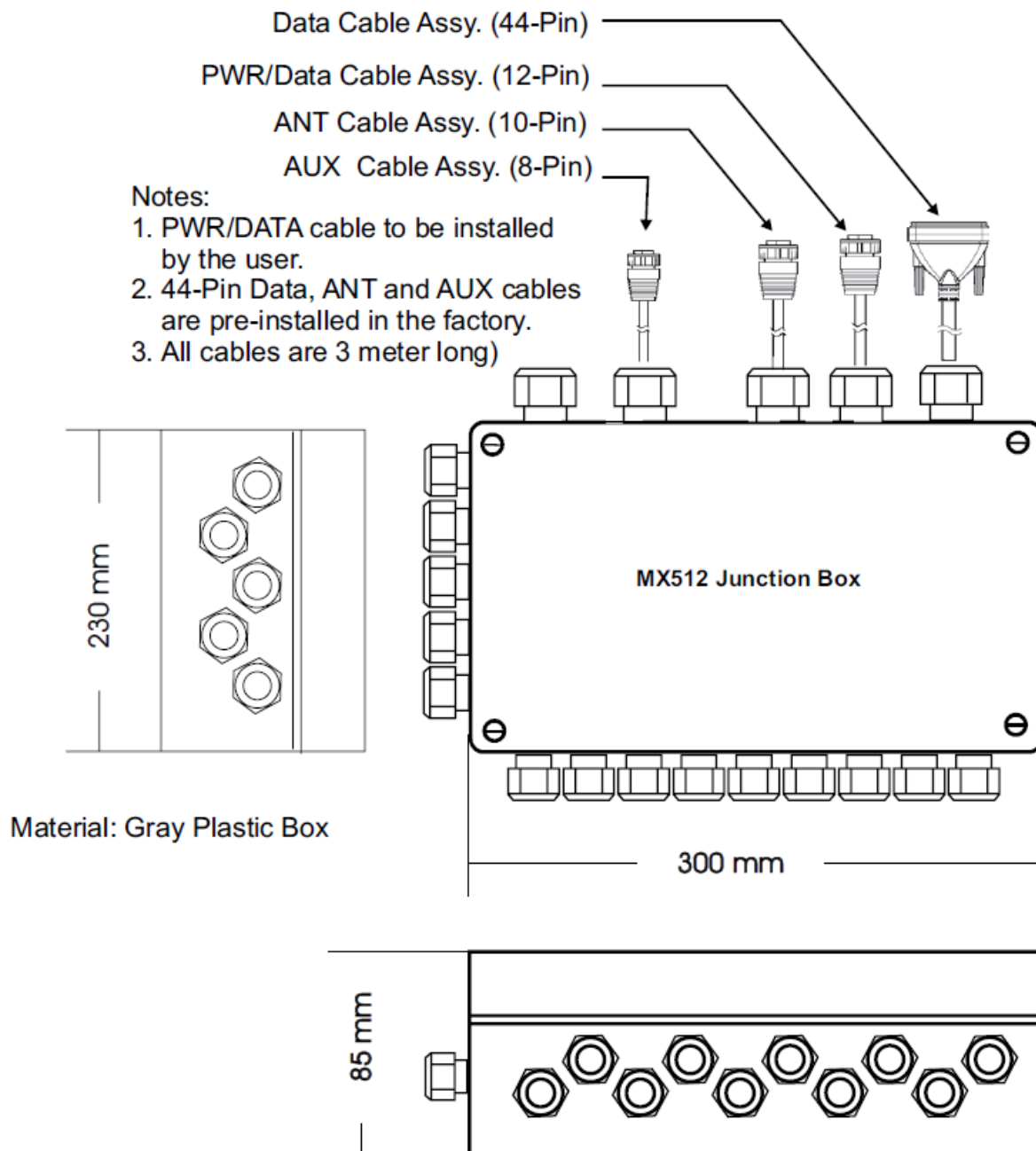


Figure 12.3 MX512 Junction Box Mechanical Drawing

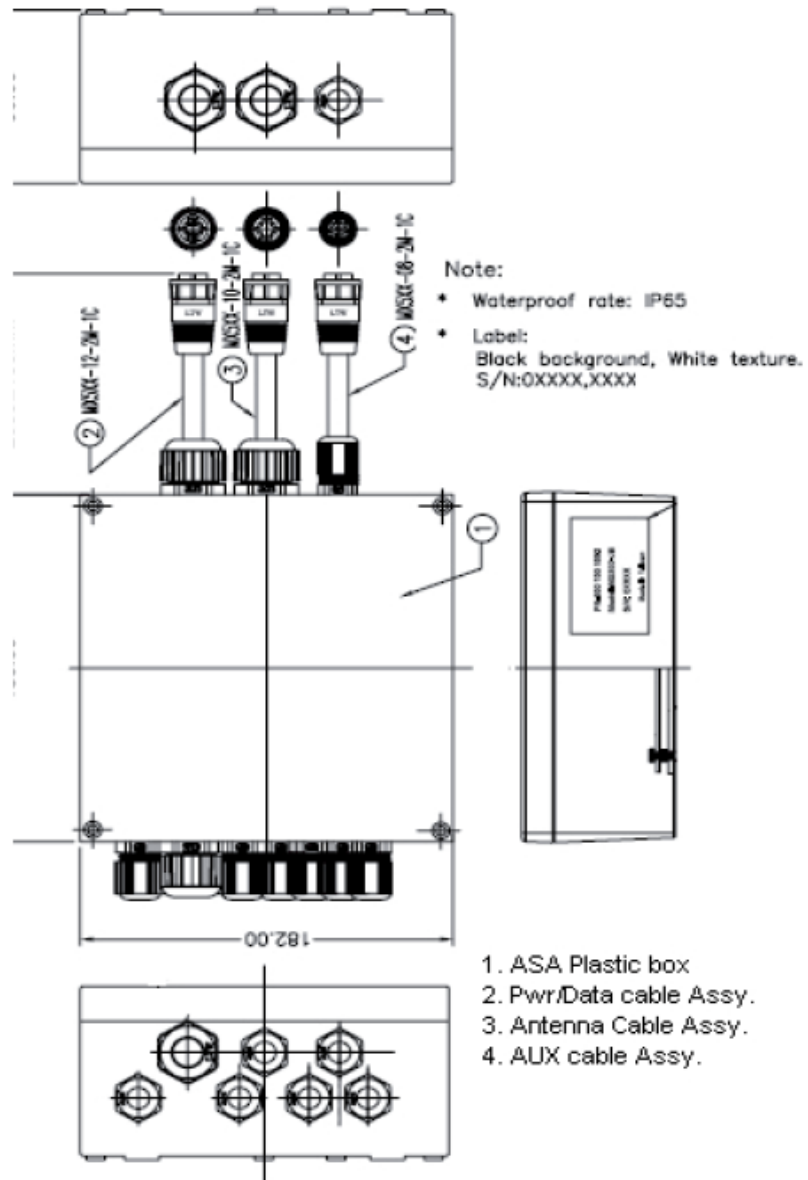


Figure 12.4 MX510 Junction Box Mechanical Drawing



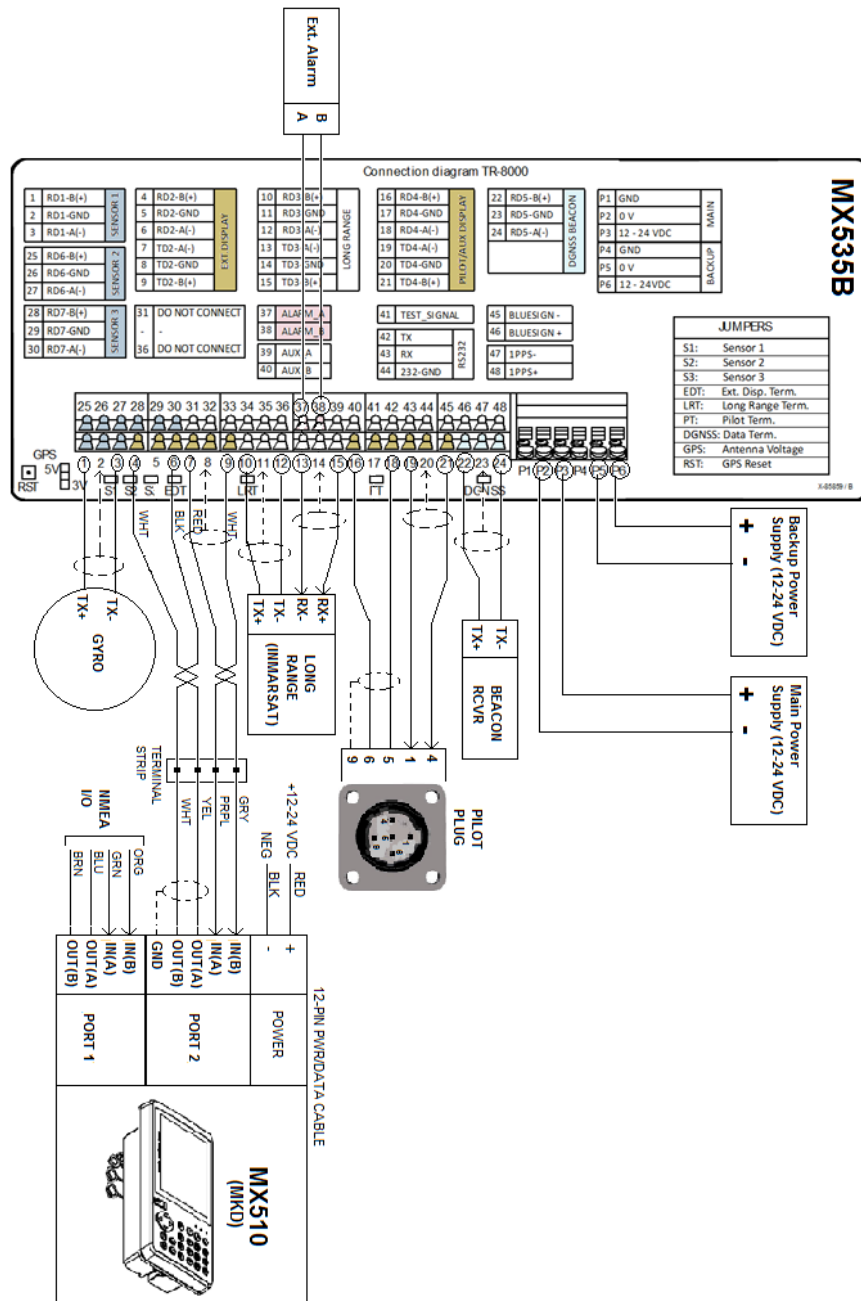


Figure 12.8 MX535/ MX510 Terminal connection Diagram

13 AIS Antenna

13.1 AIS Antenna Splitter

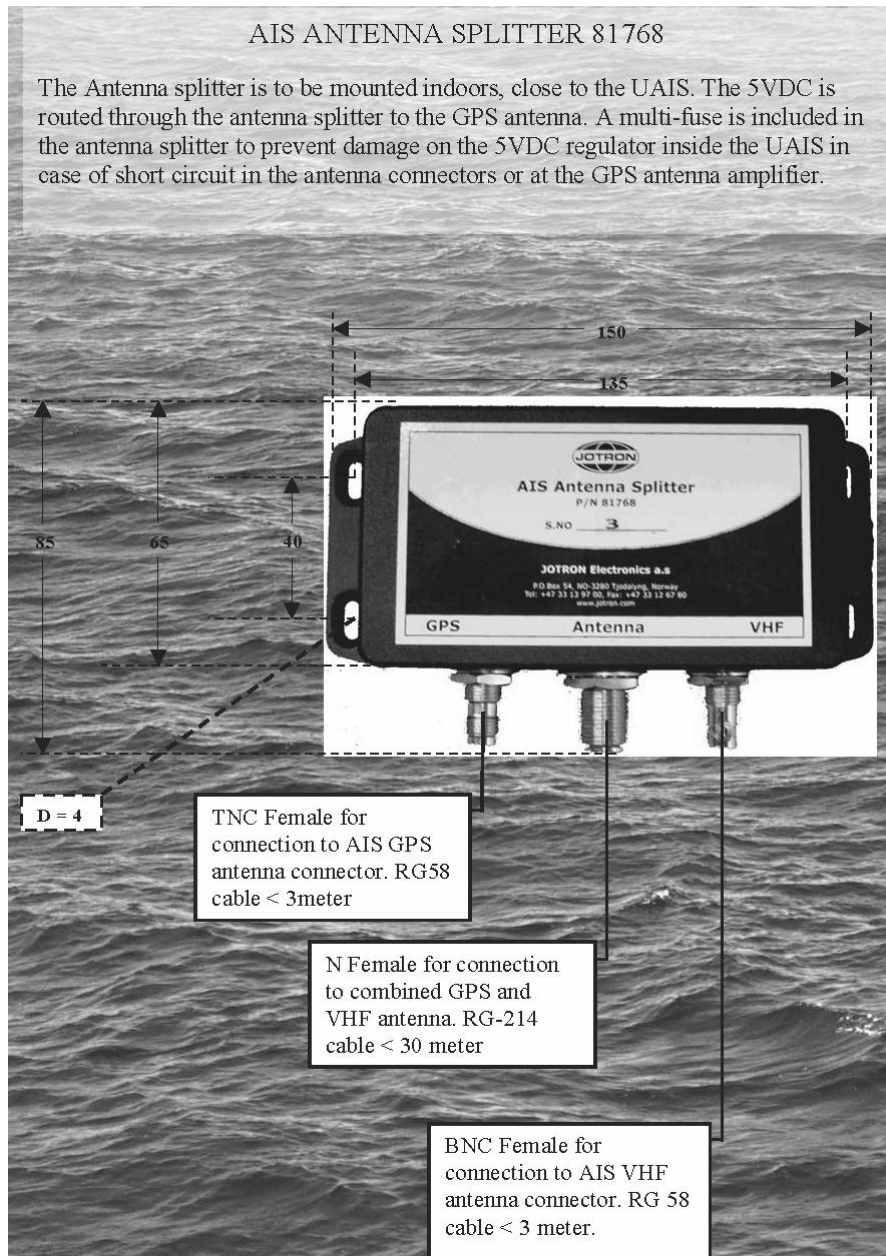


Figure 13.1 AIS Antenna Splitter Datasheet

13.2 AC Marine CX4 Maritime VHF Antenna

AC MARINE

VHF · Marine Antennas

General Description



GP2M 5/8

A 5/8 wave ground plane antenna. Suitable for fishing/commercial applications designed for mounting on a 27 mm (0.9") pipe.

The GP2M 5/8 (GP2M 5/8-2) can also be supplied for frequency range 146-174 MHz with a cutting chart included and bandwidth is 2% of F_0 .

CX4

AC Marine's bestseller throughout many years. The CX4 has a wide vertical radiation pattern and is suitable for all types of boats.

Note the wide frequency bandwidth.

CX3 5/8

The CX3 5/8 VHF marine antenna is designed for today's high performance power boats, fishing and commercial use. The antenna provides 3 dBd (6 marine dB) gain for max. performance even in high seas.

Electrical Specifications

Model:	GP2M 5/8	CX4	CX3 5/8
Frequency Range - [MHz]	156-162.5	146-162.5	156-162.5
VSWR	< 1.5:1	< 1.5:1	< 1.5:1
Gain - [dBd/Marine dB]	3/6	0/3	3/6
Polarization	Vertical	Vertical	Vertical
Connector Termination	UHF-Female	UHF-Female	UHF-Female
Maximum Power [watts]	250	100	100
Impedance - [Ω]	50	50	50
DC-Grounded	Yes	Yes	Yes

Mechanical Specifications

Model:	GP2M 5/8	CX4	CX3 5/8
Length - [m/ft.]	1.35/4.4	1.26/4.1	2.58/8.5
Weight - [kg/lbs.]	1.4/3.1	0.5/1.10	0.67/1.5
Mounting Supplied	-	See right column	See right column

Different Types

Type:	Frequency (MHz)	Mounting Supplied
CX4-0	To be specified	N-female connector
CX4-1	146-162,5	With N-female connector and N240F
CX4-2	146-162,5	With N162F Mast Bracket
CX4-3	146-162,5	-
CX4-4	146-162,5	With N-female connector and N275F
CX4-5	146-162,5	N161F Mast Bracket
CX4-6	146-162,5	With N-female connector
CX4-8	135-150	-
CX4-9	118-137	-
CX4-11	154-174	-
CX3 5/8-0	To be specified	N-female connector
CX3 5/8-10	156-162,5	-
CX3 5/8-2	149-156,0	N275F
CX3 5/8-4	149-156,0	With N-female connector
CX3 5/8-5	149-156,0	With N-female connector and N240F

Figure 13.2 AC Marine CX4 VHF Antenna datasheet

14 Abbreviations and Definitions

VHF/GPS-B

GPS Marine Antenna

VHF/GPS-B is a VHF marine antenna with a helix GPS antenna for the frequency 1575.42 MHz incorporated. The VHF/GPS-B is manufactured in premium quality materials in order to prevent galvanic corrosion.

VHF/GPS-B is subject for improvement at all times. The antenna has the same rugged design as all other AC Marine antennas thus it withstands harsh environmental conditions.

Electrical Specifications:

Frequency range (MHz)	156.0-162.5/1575.42
Nominal impedance (ohm)	50
Power for GPS 35W (VDC)	3.0-5.0
Gain (dB)	VHF:0 / GPS:18
Connector	N-female

Mechanical Specifications:

Length (m/ft)	1.1/3.6
Weight (kg/lbs)	0.65/1.43
Wind rating (m/s/mpg)	45/101
Material	Polyurethane lacquer
Colour	White
Temperature range (°C/°F)	-40 to +60 / -40 to +140

Mounting:

N240F mount included.

Can be used with standard AC Marine mounting equipment.

AC Marine A/S - Pilehøj Vaenge BE -DK-3460 Birkerød · Tel.: +45 45 8
acmarine@acmarine.dk · www.acmarine

Specifications subject to change without notice. The information in this document does not form part of any quotation or contract.

Version: 26.09.2011

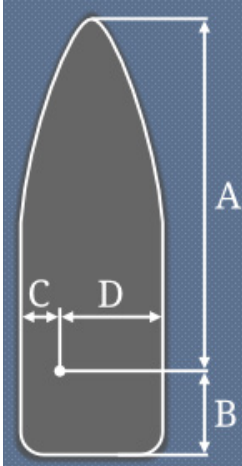
ACK	Acknowledge
AIS	Automatic Identification System - A ship borne broadcast transponder system in which ships continually transmit their position, course, speed and other data to other nearby ships and shoreline authorities on a common VHF radio channel.
AIS-SART	Automatic Identification System-Search and Rescue Transponder
AtoN	Aid to Navigation
BAUD	Transmission rate unit of measurement for binary coded data (bit per second).
BNC	Bayonet Neill-Concelman connector – common type of RF connector used for coaxial cable
BRG	Bearing
CPA	Closest Point of Approach
COG	Course-Over-Ground – Course made good relative to the sea bed.
DSC	Digital Selective Calling
DGNSS	Differential GNSS
DGPS	Differential GPS – A method of refining GPS position solution accuracy by modifying the locally computed position solution with correction signals from an external reference GPS CDU (monitor).
ECDIS	Electronic Chart Display and Information System for navigation approved to be used without paper charts
ECS	Electronic Chart System
EPFS	Electronic Position Fixing System (GPS is mostly used)
ETA	Estimated Time of Arrival. It calculates on basis of the distance to the destination and the current (or estimated) speed.
FM	Frequency Modulation – Is the method by which a signal offsets the frequency in order to modulate it on a data link.
GNSS	Global Navigation Satellite System – A common label for satellite navigation systems (such as GPS and GLONASS).
GPS	Global Positioning System – The NAVSTAR Global Positioning System, which consists of orbiting satellites, a network of ground control stations, and user positioning and navigation equipment. The system has 24 satellites plus 3 active spare satellites in six orbital planes about 20,200 kilometers above the earth.
GLONASS	A satellite navigation system developed and operated by Russia.
GMT	Greenwich Mean Time

GMDSS	Global Maritime Distress Safety System
HDG	Heading - The direction, in which the vessel is pointed, expressed as angular distance from north clockwise through 360 degrees. HEADING should not be confused with COURSE. The HEADING is constantly changing as the vessel yaws back and forth across the course due to the effects of sea, wind, and steering error.
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IEC	International Electro-technical Commission
IEC 61162-1	Maritime navigation and radio communication equipment and systems – Digital interfaces Single Talker- Multiple listeners: Closely related to NMEA0183 version 2.3, communication at 4800 baud. Is the definition of both electrical interface and protocol to be used.
IEC 61162-2	Maritime navigation and radio communication equipment and systems – Digital interfaces Single Talker- Multiple listeners, High speed transmission: Closely related to NMEA0183HS version 2.3, communication at 34800 baud. Is the definition of both electrical interface and protocol to be used.
IMO	International Maritime Organization
IP	Internet Protocol (IP) is the central, unifying protocol in the TCP/IP suite. It provides the basic delivery mechanism for packets of data sent between all systems on an internet, regardless of whether the systems are in the same room or on opposite sides of the world. All other protocols in the TCP/IP suite depend on IP to carry out the fundamental function of moving packets across the internet.
ISGOTT	International Safety Guide for Oil Tankers and Terminals
ITU	International Telecommunication Union
LAN	Local Area Network
LED	Light Emitting Diode
LCD	Liquid Crystal Display
LR	Long Range
NMEA	National Marine Electronics Association – The NMEA electronics interface specifications have been developed under the auspices of the Association. The NMEA 0183 is an internationally recognized specification for interfacing marine electronics. NMEA 0183 version 2.3 is almost identical to IEC. 61162-1.
MKD	Minimum Keyboard and Display
MMSI	Maritime Mobile Service Identity
RCC	Rescue Coordination Centre
RF	Radio Frequency

RMS	ROOT MEAN SQUARED – A statistical measure of probability stating that an expected event will happen 68% of the time. In terms of position update accuracy, 68 position updates out of 100 will be accurate to within specified system accuracy.
ROT	Rate Of Turn
RNG	Range
RX	RX is the telegraph and radio abbreviation for “receive”
SAR	Search And Rescue
SNR	Signal-to-Noise ratio (SIN). Is the quantitative relationship between the useful and non-useful part of the received satellite signal. A high SIN indicates a good receiving condition.
SOG	Speed Over Ground – Speed in relation to the seabed.
SOTMA	Self Organized Time Division Multiple Access -An access protocol, which allows autonomous operation on a data link while automatically resolve transmission conflicts.
TCP	Transmission Control Protocol – Provides a reliable byte-stream transfer service between two end points on an internet. TCP depends on IP to move packets around the network on its behalf.
TCP/IP	TCP/IP is a name given to the collection (or <i>suite</i>) of networking protocols that have been used to construct the global Internet. The protocols are also referred to as the DoD (<i>dee-oh-dee</i>) or Arpanet protocol suite because their early development was funded by the Advanced Research Projects Agency (ARPA) of the US Department of Defense (DoD).
TCPA	Time to Closest Point of Approach
TI	Turn Indicator
TNC	Threaded Neill-Concelman connector – common type of RF connector used for coaxial cable
TX	TX is the telegraph and radio abbreviation for “transmit”
UDP	User Datagram Protocol – Provides a packetized data transfer service between end points on an internet. UDP depends on IP to move packets around the network on its behalf.
UTC	Universal Time Coordinated – Greenwich mean time corrected for polar motion of the Earth and seasonal variation in the Earth's rotation.
VDC	Volt DC
VDL	VHF Data Link
VHF	Very High Frequency – A set of frequencies in the MHz region
VSWR	Voltage standing wave ratio

15 MX535B AIS Installation – registration form

Vessel name		IMO Number	
Flag State		MMSI Number	
Owner / Company		Radio Call Sign	
On-Board Contact Name		Telephone Number(s)	Office:
			GSM:
Superintendents Name		Telephone Number(s)	Office:
			GSM:
Type of Vessel		Gross Registered Tonnage	GWT
L.O.A.	mtrs	Beam	mtrs
Comments:			
MX535B Transponder unit, serial number:			
MX535B Display unit, serial number:			

	Antenna Location		GNSS Antenna connected directly to MX535B (Internal)
	A=Distance to Bow	mtrs	mtrs
	B=Distance to Stern	mtrs	mtrs
	C=Distance to Port Side	mtrs	mtrs
	D=Distance to Starboard side	mtrs	mtrs

Installation completed and successfully commissioned by:

Technician, (type name)		
Service provider / company		
Place	Date	Signature

Please fill in with capital letters

This form must be sent to Simrad, beacon@Simrad.com or Fax: + 310 791-6108 (Attn: Service department) in order to have a valid 12 months product warranty.

15.1 Trouble Description Form

For better to help you if your system fails, please give as much information as possible in the following tables:

Transponder Unit Information	Information from System Menu
Serial number	
Software version	
Model code	
Hardware revision	

Display Unit Information	Information from System Menu
Serial number	
Software version	
SVN revision	
Hardware revision	

Transponder Unit Connections:	Equipment:
Sensor 1	
Sensor 2	
Sensor 3	
Ext Display Port (RS-422/RS-232/LAN)?	
Pilot Port	
Long Range Port	
DGNSS Data Port	

Display Unit Connections:	Equipment:
Pilot Port	

Trouble Description:

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